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A
SYSTEM OF SURGERY

THEORETICAL AND PRACTICAL

IN

TREATISES BY VARIOUS AUTHORS.

EDITED BY

T. HOLMES, M.A. CANTAB.

SURGEON AND LECTURER ON SURGERY AT ST. GEORGE'S HOSPITAL :
MEMB. CORRESP. DE LA SOCIÉTÉ DE CHIRURGIE DE PARIS.

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DISEASES OF THE EYE.

CHAPTER I.

OPTICAL DEFECTS.

Emmetropia (*Refraction and Accommodation*).—*Ametropia* (*Myopia, Hypermetropia, Presbyopia, Astigmatism*).

ASSUMING the reader to be acquainted with the general laws of optics, I may begin by saying a few words about the eye as an optical instrument; and may then briefly describe those defects in its refraction and accommodation which interfere with the perfect performance of its functions.

The terms Emmetropia and Ametropia* have been invented by Donders to designate the normal and the abnormal state of the eye in respect of its refractive phenomena. An eye of perfectly normal refraction, in which parallel rays of light meet in a focus on the retina, Donders calls emmetropic—*Emmetropia* implying 'sight within due measure' (*Ἔμμετρος*, within measure, and *ὤπια* the terminal modification of *ὤψ*, sight). An eye in which parallel rays come to a focus either in front of or behind the retina, he calls *ametropic* (*ἀ* and *μετρωπία*).

Although we familiarly speak of the rays of light that come to us from distant objects as being parallel to each other, yet, strictly speaking, all luminous rays pass off from their source

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* The generic term *Ametropia* is seldom employed, inasmuch as that special form of it which happens to be immediately under observation, leads one to use the terms *Myopia*, *Hypermetropia*, or *Presbyopia*. But were the word 'Ametropia' often pronounced by Englishmen, it would be constantly liable to be mistaken for 'Emmetropia,' its direct opposite, in consequence of the peculiar sound of our close *a*. On the Continent, where the *a* has uniformly its broad open sound (as in *father*), this confusion cannot occur. Our strictly English eccentricity might have been indulged, while at the same time the distinction between the two generic terms would have been made even more marked, if *Ecmetropia* had been chosen as the converse of *Emmetropia*.

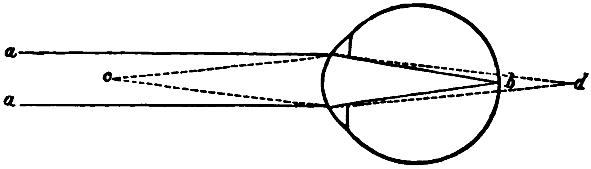
divergently. It is obvious, however, that the divergence of any rays falling on the eye must become less in proportion as their source is removed farther off; so that by the time the rays from a distant object are passing through the small aperture of the pupil, their divergence has become so trifling that, for all practical purposes, they may be regarded as parallel.

In considering the eye as an optical instrument, we have to do only with those rays of light which are admitted by the pupil—they alone being concerned in vision.

While in a perfectly formed, and normally refractive, or emmetropic eye, the rays from distant objects would naturally come to a focus upon the retina, and there form a picture which is to be recognised by the sensorium, the rays from near objects, falling on the surface of the cornea in a state of more or less divergence, would, in passing on through the refractive media of the organ, tend towards a focus behind the retina. (Fig. 140.)

To effect near vision, therefore, it becomes necessary that the media should undergo such a change as will bring divergent rays to an exact focus on the retinal surface. This change is the result of an active effort which is called *Accommodation.*

FIG. 140.



Emmetropic eye in a state of rest. Parallel rays, *a*, *a*, come to a focus on the retina at *b*. Rays from a near object, *c*, being divergent, tend towards a focus behind the retina, *d*. The act of accommodation, which consists in increased convexity of the lens, causes these divergent rays to converge to a focus at *b*.

Various theories have at different times been suggested to explain the mechanism of this act of adjustment or accommodation of the eye to near objects. First, it was said that by a contraction of the recti muscles the eyeball was compressed on all sides, and thereby elongated in its antero-posterior diameter, and thus the retina was actually removed backwards into such a position as enabled it to receive upon its surface the exact focus of the rays. Secondly, according to another theory, the act of accommodation consisted in an increased curvature of the cornea. This Home and Ramsden considered themselves to have proved by conclusive experiments. Thirdly, it was maintained that the lens was moved bodily forwards.[*]

Three of the foregoing theories of accommodation are evidently fallacious. 1. In a case of total paralysis of the third, fourth, and sixth nerves, all the ocular muscles are inert, and yet the patient's vision of near objects remains totally unimpaired. 2. The curvature of the cornea has been carefully tested, and found not to vary during the act of accommodation. 3. No apparatus exists adequate to move the entire lens forward to an extent sufficient for the purpose of accommodation. During the performance of the delicate experiments I am about to allude to, no change in the position of the entire lens could be detected. 4. An increase in the convexity of the lens, especially of its anterior surface, is now universally accepted as the cause of the eye being accommodated to near objects.[†] Theoretically such a change of form will account for the attainment of the end in view; and practically it has been found, by carefully watching the alterations in the reflected images of a flame held in front of the eye, that, while the reflection from the surface of the cornea remains totally unchanged during the act of accommodation, the images reflected from the anterior and posterior faces of the lens (Purkinje's [‡] images they are termed) change both their size and relative position.

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[*] This movement was effected, according to Porterfield, by a contraction of the ciliary processes; or, as he termed them collectively, the *ligamentum ciliare.* Porterfield, however, knew nothing of the existence of what is now called the 'ciliary muscle.' (See his *Treatise on the Eye*, &c. 1759, vol. ii. p. 4.)

[†] This theory was first published by Young in 1793; but along with it he brought forward the mistaken notion that the change in the shape of the lens was owing to its possessing an inherent power of contraction, due to its being wholly made up of muscular fibres and tendons. This anatomical error had been previously advanced by Pemberton, in 1719. In 1796, Young retracted the theory he had brought forward three years before, declaring it to be 'neither new nor true,' and accepted the change of curvature in the cornea as the efficient cause of accommodation. At a later period (1800), while he abandoned the opinion that the lens was muscular, he still maintained that it possessed within itself a power of changing its form, and that by increasing its convexity, it adapted the eye to near objects. (*Phil. Trans.* 1801.)

[‡] The following is Purkinje's experiment, which, before the invention of the ophthalmoscope, was frequently employed as a 'catoptric test' of the presence of incipient cataract. The patient, with his pupil dilated, is placed in the dark, and a lighted taper is then held on a level with, and at a few inches from the pupil. Three images of the flame are then perceived; one, large, distinct

The ciliary muscle is now generally believed to be the active agent in changing the shape of the lens during accommodation, but the precise mode in which the process is effected is not easy to explain. The iris also seems in some way to aid the ciliary muscle, but that the iris is not the chief agent in accommodation is proved by the fact that, in cases where it is absent from birth (*Irideremia*), or where it has been removed from the eye by an accident, accommodation seems but little impaired.

The temporary loss of accommodation in persons who have severely suffered from diphtheria illustrates the dependency of the function on some form of muscular action. In such patients, long after all their acute throat-symptoms have passed away, and they are resuming their ordinary employments, a remarkable weakness in some of the small muscles of the body becomes manifest; the palatal muscles are found to be impaired in their action, and at the same time the power of reading is lost, or it can be exercised only for a few seconds. This defect of vision is not due to any impairment of the optic nerve, for a convex glass held in front of the eye at once compensates for the loss of accommodating power, and enables the patient to read clearly.

Near and far points of distinct vision.—There is a limited range within which small objects, printing-types, for instance, can be distinctly seen by a healthy, or emmetropic, eye. If they are brought nearer to the eye than a certain point, they can no longer be recognised. This is called the 'near point of distinct vision.' If the types be moved farther off, they can still be read until they have receded to a certain distance, when they again become indistinguishable. The space comprised between these two points is called the 'range of accommodation.'

The *far-point* in an emmetropic eye is said to be 'at an infinite distance.' That is to say, rays of light from the most distant objects, the stars for instance, come to a focus upon the retina while the eye is in a state of rest. It is evident that if we use 'infinite' in its strictly etymological sense, no two things

---

and upright, is reflected from the cornea; two others, much smaller than the corneal one, appear within the pupil. Of these deeper images, one, inverted, is reflected from the hinder face of the lens; the other, upright, from its front surface. If the taper be now slowly moved from side to side, the inverted image, which is always ill-defined, quits its position between the two upright images reflected from the cornea, and from the front of the lens, and glides away in a direction opposite to that in which the taper is moved.

can be at an infinite distance from each other. The word, however, is technically applied to rays which, being inappreciably divergent, are therefore treated of as if really parallel; not only such as come to us from one of the heavenly bodies, but even from an object several yards off. As some distance must be assigned respectively limiting the bounds of finite and infinite rays, twenty feet is commonly spoken of as the distance by ophthalmic writers; appreciably divergent rays, coming to the eye from an object less than twenty feet distant being called 'finite,' and those from all objects beyond that distance 'infinite.'

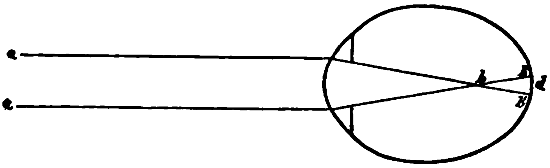
Ametropia.—The chief forms of ametropia are those popularly known as 'short-sight,' and 'long-sight.' The latter, in its true meaning, will come to be considered under the term presbyopia; but there is another form, the clear discrimination of which we owe to Donders, and to which he has given the name of 'Hypermetropia.' It is a very common affection, depending on original malformation of the eyeball, and affecting therefore persons of all ages. In short-sight (*Myopia*), parallel rays such as pass to the eye from a distant object, come to a focus in front of the retina; in Hypermetropia the rays tend to a focus behind the retina.

On the same principle of terminology which induced Donders to name this defect Hypermetropia—the sight being, as it were ὑπέρμετρος, above the measure—short sight would be called *Hypometropia* (ὑπόμετρος, below the measure); but Donders had chosen to retain the term 'Myopia' for two reasons; first because the word is established and universally accepted, and secondly, because the similarity of sound between 'hypo' and 'hyper' would be apt to cause confusion and misunderstanding.

In *Myopia* (Fig. 141) the eye is adapted for bringing divergent rays to a focus on the retina; but parallel rays come to a focus in front of it, and then, again diverging, pass on to form upon its surface what are called 'circles of dispersion,' and thus an ill-defined image of a distant object is produced.

A concave glass, of a curvature proportioned to the degree of myopia, held in front of the eye, causes parallel rays to diverge before entering the pupil, and they are then reunited, and brought to a focus exactly upon the retinal surface (*d*). The cause of myopia consists either in the media of the eye, especially the lens, being too highly refractive, or in the eyeball itself being too long from before to behind. This elongated, ovoid form of the eye is best seen when the patient forcibly adducts it.*

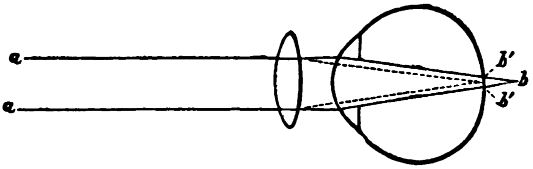
Fig. 141.



Myopic eye: too long in its antero-posterior diameter. Parallel rays, before reaching the retina, come to a focus at *b*; then, crossing, they form on the retina circles of dispersion at *b'*, *b'*.

In *Hypermetropia* (Fig. 142) the parallel or quasi-parallel rays from distant objects tend towards a focus behind the retina, while the divergent rays from near objects cannot be brought to a focus on the retina until, by artificial means, they have been made to converge. A hypermetropic patient, therefore, sees neither distant nor near things distinctly. Hypermetropia is caused either by the eyeball being too short from before to behind (Fig. 142), or by the refraction of its media being too low; or both these conditions may be combined. Convex glasses, of suitable focal length, make both distant and near objects distinct, by causing parallel and divergent rays to converge, and thus bringing them to a focus on the retinal surface.

Fig. 142.



Hypermetropic eye; too short in its antero-posterior diameter. Parallel rays, tending towards a focus at *b*, form on the retina circles of dispersion at *b'*, *b'*. Divergent rays would tend towards a focus still more distant than *b*.

Presbyopia (πρέσβυς, aged). Persons who originally have had excellent sight, both for distant and near objects (*Emme-*

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* Porterfield says: 'By myopes I understand such as have the cornea and crystalline, or either of them, too convex, or that have the distance betwixt the retina and crystalline too great.'—*A Treatise on the Eye, &c.* Edinb. 1759, ii. p. 36.

tropia), as they advance in life find that, while their distant sight is as acute as ever, near objects become more and more indistinct. Type is held farther and farther from the eyes, as the 'near point' recedes. The accomodating power has become impaired, partly by the lens acquiring greater firmness, and therefore being less able to yield to that force which ought to render it more convex when near objects are looked at; and partly from that force itself becoming weaker. A convex glass, of such a curve as will bring back the receded 'near point' to its normal position, at once renders near objects distinct.

Although a presbyopic and a hypermetropic person may both be seen using convex glasses for reading, the state of their vision is very different. The presbyopic person may have been originally emmetropic, his eyes in a state of rest bringing parallel rays to a focus on the retina, and his accommodating power, by changing the form of his lens, serving also to bring to a focus on the retina the divergent rays from near objects.

In the hypermetropic person, on the contrary, sight was always defective, both for distant and for near objects. On account of its short anterior-posterior diameter, the eye, while in a state of rest, could not receive upon the retina parallel rays; they all tended to a focus behind it, while the divergent rays from near objects could not be focussed on the retina until they had artificially been changed into convergent ones.

Presbyopia and hypermetropia, therefore, are the direct contrasts to each other. Even a myopic patient, in advanced age, will sometimes be found to a certain degree presbyopic, in consequence of the failure in accommodation which is induced by increased density in the tissue of the lens.

*Astigmatism.**—In an eye otherwise perfectly formed the cornea may be unsymmetrical, so as to present different curves accordingly as its anterior surface is measured vertically, transversely, or obliquely. The rays of light, therefore, as they fall on one or other of these meridians of the eyeball, become differently refracted, and cannot all meet at one point or focus.

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* *Astigmism* would be the more correct term, *στιγμή* (*στιγμῆς*), being commonly used by Greek writers to express a geometrical point, while *στίγμα* (*στίγματος*), always signifies something material, more or less visible or tangible —a puncture, mark, or spot. I took the liberty of pointing this out to the late eminent scholar Dr. Whewell, who had originally suggested the word 'Astigmatism,' and he approved of *Astigmism*, as being etymologically the better-formed word.

The researches of Donders and others show that astigmatism, at least in a slight degree, is by no means so uncommon as was formerly supposed. It is best detected by making the patient look at a paper on which are drawn vertical and horizontal lines of equal thickness, and noting which lines become the more clearly defined at a given distance. Young, who was himself affected with astigmatism, was the first to describe this peculiarity of vision.* He believed the cause to be in his lens, which he imagined to be placed obliquely to the axis of vision. Airy † next published an account of this condition, as affecting one of his own eyes, and he invented a glass of a peculiar form to correct the irregular refraction. Glasses of this kind are now commonly used, under the name of cylindrical or astigmatic glasses. Such a glass must be a segment of a cylinder, the axis of which is then placed before the eye vertically, transversely, or obliquely, according to the meridian of irregular refraction. For a myopic or hypermetropic patient the glass must be concavo-cylindrical or convexo-cylindrical. An instrument for determining the precise direction of the axis of a symmetry has been invented by Laurence.

I may now make a few remarks on some special points in the diagnosis and treatment of Myopia and Hypermetropia.

As I have already observed, a myopic eye is so formed as to be adapted for bringing strongly divergent rays to an exact focus on the retina; and therefore the minutest near objects are often seen with extraordinary clearness of definition, so that a 'diamond' type can be read with perfect ease at a distance of four or five inches, although at only double that distance it becomes quite illegible. As soon as the object has been removed beyond the far-point of distinct vision, the rays, after coming to a focus in front of the retina, again diverge, and form upon it the 'circles of dispersion' already alluded to. The farther the object is removed from the eye, the larger these circles become; and the patient instinctively brings the edges of his lids close together, as he finds by experience that, by thus cutting off some of the rays which would otherwise enter the pupil, the dimness caused by the circles of dispersion is diminished.

There is an endless variety in the range of accommodation among myopic patients. Some can read the smallest type at a distance of 5 or 6 inches, others only at 2 inches from the cornea. Each case must be examined and judged of by itself, for there are many complications which may prevent our always applying the same unerring rule for deciding what form of concave glass is required to neutralise the myopia. Commonly, however, we may ascertain what degree of concavity will suit for clear vision of distant objects by noting at how many inches from the cornea a small test-type can be distinctly read, and then giving the patient for distant objects a concave glass of corresponding focal length. Thus a patient who with the naked eye can define the test-type only at 5 inches is said to be myopic $\frac{1}{5}$, and a concave glass which would neutralise a convex one of 5 inches focus, and which is distinguished as —5″, will enable him to see distant objects with accuracy.

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* In the year 1800; *Phil. Trans.* 1801.

† In 1825; *Trans. of the Cambridge Phil. Soc.* vol. ii. p. 257. In his second paper, 1846 (*Trans.* viii. 361), he mentions that Whewell had suggested the name 'Astigmatism' to designate the affection.

In determining what arrangement of glasses should be made use of, the degree of myopia and the patient's general circumstances must be considered. If his sight for near objects be acute, and his amount of myopia not very great, the occasional use of a hand-glass or spectacles may be enough; but in no case should a single glass be employed. The habitual use of a glass to one eye, has in some cases a tendency to induce in the other a feebleness of vision, and a slight eversion of the eyeball. When the myopia is so considerable that type cannot be discerned unless held within 2 or 3 inches of the cornea, spectacles ought constantly to be worn.

In speaking of hypermetropia, I said (p. 6.) that, in consequence of a short antero-posterior diameter of the globe, neither parallel nor divergent rays could be brought to an exact focus on the retina. Now these are the only rays that are met with under natural conditions; or rather, as I have already observed, all luminous rays, strictly speaking, fall upon the surface of the eye with a greater or less amount of divergence. Convergence of rays is always an artificial result, caused by their transmission through a convex lens.

The unassisted hypermetropic eye, therefore, sees neither near nor distant objects distinctly; but the difficulty of seeing near and small things is so much more obvious to the patient than his inability to define distant ones, that he commonly seeks medical advice on account of difficulty in reading. To make the retinal image larger, he often brings the type near to the eye, and hence believes himself to be 'short-sighted.' But even when held near, he can only read it for a very short time, with a constant painful effort, and a sense of straining and fatigue; and when the defect exists in a very high degree, reading is altogether impossible.

The only remedy for hypermetropia is the use of convex glasses. The cause of the defect was formerly very imperfectly understood, although its results were familiar to every ophthalmic surgeon, and constituted one of the most troublesome and unsatisfactory portions of his practice. Under the vague title 'Impaired Vision,' cases of hypermetropia were treated with an endless variety of external and internal medicines, all equally fruitless.

The focal length of the lens necessary for giving such convergence to parallel and divergent rays as may suffice to bring them to a focus on the retina affords a designation for the degree of hypermetropia. Thus if a glass of 10 inches focus produces upon the retina an exactly defined image of the test-type, while distant objects are clearly seen with a glass of 30 inches, the patient is said to be hypermetropic $\frac{1}{10}$ and $\frac{1}{30}$.

As hypermetropia depends upon an original malformation of the eyeball, children affected with it must be provided with suitable spectacles, or they will be unable to read sufficiently for the common purposes of education. Donders insists on the necessity for spectacles being constantly worn by hypermetropic patients, so as to prevent over-exertion of the effort of accommodation; but we can hardly expect a school-boy to play in spectacles, however willingly he may resign himself to them as indispensable for study, and we must in most cases content ourselves with insisting on their being always used for reading, writing, drawing, &c. Adults who, although hypermetropic, have committed themselves to unsuitable occupations, involving continuous application to near objects—clerks, compositors, tailors, needlewomen—will usually be willing enough to wear spectacles at all times. In some cases one pair of glasses will suffice, in others more convex lenses will be needed for near objects, and less convex ones for distance.

Test-types.—It is evident that in examining a patient's sight some definite tests must be selected, and printing-types are the best and most convenient objects. As freer intercourse was established between different countries, it became more and more desirable that some uniform standard of reading-tests should

TEST TYPES:

Corresponding in size to the 'Schrift-Scalen' of Professor Jæger. (1860.)

No. 1.

First, I was to prepare more land, for I had now seed enough to sow above an acre of ground. Before I did this, I had a week's work at least, to make me a spade, which, when it was done, was but a sorry one indeed, and very heavy, and required double labour to work with it. However, I went through that, and sowed my seed in two large flat pieces of

No. 3.

ground, as near my house as I could find them to my mind, and fenced them in with a good hedge, the stakes of which were all cut of that wood which I had set before,

No. 5.

and knew it would grow; so that in one year's time I knew I should have a quick or living hedge, that would want but little repair. This

No. 6.

work was not so little as to take me up less than three months, because a great part of that time was of the wet

No. 8.

season, when I could not go abroad. Within doors, that is when it rained and I could not go

No. 10.

out, I found employment on the following occasions; always observing that, all the

No. 12.

while I was at work, I diverted myself with talking to my parrot,

No. 14.

teaching him to speak. I quickly taught him

No. 15.

to know his own name, and at last

No. 16.

to speak it out pretty loud 'Poll,'

No. 18.

it was the first word

No. 19.

I ever

No. 20.

heard

be agreed upon, so as to enable ophthalmic surgeons to understand the reports of each other's cases. The sizes of printing-types, however, are not everywhere the same, and persons are usually unacquainted even with the typographical terms of their own country—*pearl*, *minion*, *brevier*, *bourgeois*, *pica*, &c.—unless they happen to have had some practical experience as authors. When, therefore, E. Jæger published in 1854 a series of printed tests, the letters of which were distinguished by numbers instead of by technical names, they were generally accepted by the profession, and referred to in reporting cases. More recently Snellen has devised a special form of type, in which the letters are all drawn on a regularly proportioned scale of thickness of stroke.* In doing this, he has acted on the following principle. If the eye be taken as a centre, and from it a circle be described of 12 inches in diameter, a well-illuminated object occupying only $\frac{1}{60}$ of a degree in this circle can be recognised. In other words, certain objects, the size of which is about $\frac{1}{600}$ of an inch, can be seen by an emmetropic eye, at a distance of 6 inches. Such objects, however, as printing-types cannot be distinctly perceived at a smaller visual angle than about five minutes of a degree. Snellen's letters, therefore, are uniformly drawn in lines the thickness of which is equal to one-fifth of the whole letter, so that, while a letter occupies five minutes of the field of vision, each line composing the letter would occupy a space of only one minute. Each size of Snellen's type is distinguished by a figure, indicating the number of feet at which the letters ought to be legible to an emmetropic eye. In a second edition of his test-types (1864) Snellen printed some tables of 'test-dots,' which may be used by persons who cannot read. These dots had been contrived by the British army authorities for determining the acuteness of vision in recruits.

No doubt the principles on which Snellen's letters are formed are more scientific than those which regulate Jæger's, and are to be preferred in cases where optical experiments are made on intelligent and educated persons. But those of limited reading powers, especially in hospital practice, are often puzzled by the unusual forms used by Snellen, and cannot read them fluently, even when quite able to read the ordinary type they are accustomed to in books and newspapers.

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* It is only with letters of a certain size, however, that Snellen has carried this plan into effect. The larger letters are all drawn on the principle he lays down, but his letters No. 1, No. 2, and No. 3, are all printed from ordinary thick and thin metallic types. (*Test-types for the Determination of the Acuteness of Vision*, 3rd edit. 1866.)

CHAPTER II.

EXAMINATION OF THE EYE.

Superficial Examination.

The Conjunctiva and Cornea.—For examining the former of these structures, when attacked with the slighter forms of ophthalmia, no special manipulations are required. The ocular portion is open to the surgeon's observation, and, to explore the lining of the lower lid, it is only necessary to depress the tarsus with the point of the finger. It is often difficult, however, to obtain a satisfactory view of the cornea in a child suffering from that irritable form of inflammation commonly known as *Scrofulous Ophthalmia*, but more correctly called *Keratitis*. The surgeon does but waste his time who attempts to coax or parley with such a patient. Light causes so much pain, that the child makes every effort to exclude it, by keeping the eyelids firmly pressed together, and even, in severe cases, thrusting his face against the pillow, or the dress of the attendant.

The surgeon should sit, and spread a folded towel across his knees. Opposite to him sits the attendant, who secures the child's hands, and lowers him backwards until his head is received between the surgeon's knees, and there firmly held. Thoroughly to expose the cornea without everting the lids requires tact, which practice alone can give. The extreme tip of the fore-finger, with a bit of rag twisted over it to prevent slipping, having been laid upon the middle of the upper tarsus, at the very edge—between the roots of the eyelashes and the globe—the lid, without any dragging of the skin, is to be steadily pushed in a direction which, in the erect position of the body, would be upwards and backwards. In this way the greater part of the cornea is at once exposed; but if the finger is allowed to drag the skin of the lid, the tarsal cartilage instantly becomes tilted over, and the swollen conjunctiva, bulging forwards, hides the eyeball from view. By a similar manœuvre the lower lid may be depressed; but this is not necessary in examining the cornea, for that part is always rolled upwards to seek the shelter of the upper lid.

If a more prolonged examination of the eyeball be required, as in a case of *Ophthalmia neonatorum*, a spring speculum must be employed, adapted, as regards width and strength of spring, to the small size of the palpebral fissure.

To expose the conjunctiva of the upper lid, the part must be everted, as if the surgeon were in search of a foreign body; and, indeed, it is with such an object that the eversion is most frequently performed. Whenever a patient complains of having had a fragment of anything blown into the eye, and a careful scrutiny of the edges of the tarsi, the fold of the lower lid, and the surface of the globe, has failed to reveal the cause of irritation, the upper lid should be treated in the following manner:—A pen, the extreme feather end of which is cut off, so as to leave a stem just thick enough to resist bending, is laid across the upper lid, about half an inch from its free margin; then, while the finger and thumb of the other hand grasp the eyelashes growing from the middle of the lid, the pen is pressed a little downwards, at the same moment that the lid is drawn first a little forwards, and then upwards; the tarsus will suddenly tilt and fold over, so as to expose its conjunctival surface.

This manœuvre, simple as from description it seems to be, requires a good deal of *knack*. Both hands must act together, and if at the moment the turn is being given to the lid, the patient is told to look downwards, the eversion is much more readily accomplished. Minute foreign bodies, which have fixed themselves beneath the upper lid, are almost invariably found very near its tarsal margin; they should be lightly picked off with the feather or nib of the pen used for effecting the eversion. A pen is not only more convenient than a probe, but it has the advantage of appearing less formidable to a timid patient.

Lens and iris.—Great care is required in examining a patient in whom we have reason to suspect that Cataract is commencing. The first faint streaks of opacity in a lens will often escape detection, unless light be concentrated on the part by means of a convex glass of about an inch focus. I need hardly say that in all daylight examinations of the eye, the direct rays of the sun are to be avoided. The observer must also take care that light does not fall upon the cornea from more than one window;

and that reflections from mirrors and other polished surfaces do not interfere with the single ray of direct light which should fall on the part to be examined. No lens can be fully seen until the pupil has been widely dilated with atropine; but inasmuch as this dilatation alters the visual condition of the eye, all particulars as to the patient's range and distinctness of sight should be noted before the atropine is applied.

In the very earliest stages of Cataract, examination by daylight, even when the light is concentrated by a convex glass, may sometimes fail to detect alteration in the lens. Neither can this be made out with the ophthalmoscope. But if in a darkened room the rays of a flame be thrown sideways upon the lens, by means of a convex glass, and the part be then carefully scrutinised with the naked eye, highly refractive dots, like minute oil-globules—which probably they really are—will be found scattered throughout the substance of the lens, the fibres of which also are now made visible as delicate radiating lines.

The contractility of the iris is tested by placing the hand close to the eye for a second or two, and then quickly withdrawing it, so as to allow the light to fall suddenly upon the pupil, the other eye meantime being closed. The sympathy between the two eyes should next be examined, by observing how far light admitted to one eye influences the iris of the other.

This separate examination of each eye is a very important point, for cases occur in which, while one eye is sound, the other is so utterly blind as to have lost all perception of light, yet the pupil of this blind eye will contract as soon as light is admitted to the sound one. An extensive adhesion between the edge of the pupil and the capsule of the lens (*Synechia posterior*) would at once attract notice; but if any slight deviation from the healthy round form of the pupil exists, its margin must be carefully examined, to see if any very small adhesion be the cause of such irregularity. A very slight synechia often affords a valuable hint towards diagnosis, as proving that iritis must at some period or other have attacked the eye. Whenever the surgeon is in doubt as to the existence of adhesions, the application of atropine will determine the question.

It should ever be borne in mind that a dilated and inactive pupil by no means necessarily implies that the retina is diseased; nor an active pupil that the retina is sound. If one pupil be large and immovable, and the sight of that eye dim, the patient should be made to look at type through a large pin-hole in a card eld close to the cornea. The object of this will be explained nder the head 'Mydriasis.'

We must never be satisfied with a patient's vaguely telling us hat he can or cannot read; we must have a precise and defiite standard, such as is afforded by his reading to us aloud rom type of several sizes. In hospital practice, those who have ot learned their letters—who, as they express it, are 'no cholars'—may be told to count small dots, point out a single nd a double line, or select an asterisk from other typographical marks. This subject has been more fully treated under the head of 'Optical Defects.'

The simple modes of examination hitherto mentioned have at all times been at the surgeon's command; I come now to consider the use of an apparatus—the *Ophthalmoscope*—the invention of which has enabled us to explore those deeply-seated structures previously altogether beyond the range of observation.*

OPHTHALMOSCOPIC EXAMINATION.

It is little more than twenty years since Cumming † first demonstrated that, by a certain arrangement of light, the fundus of the healthy human eye could be made visible, so far at least as to allow of its colour being seen. Although he never obtained a view of the optic nerve or vessels of the retina, his investigations prepared the way for the discovery of the ophthalmoscope, by proving that the fundus of the living eye was not really a dark-coloured surface; but that under certain conditions it reflected the rays of light falling upon it, so as to present a brilliant surface to the eye of the observer. An indistinct reddish gleam from the retina, or a white reflection from the optic nerve, had been sometimes accidentally seen by those engaged in the study of eye-diseases; but they had regarded these glimpses of the fundus of the eye as exceptional, and as indicating something morbid in the deep tissues. Thus, in certain cases of impaired sight, with dilatation of the pupil, Beer had observed a peculiar luminous appearance, which he assumed to be the result of some morbid change in the retina; and he accordingly made use of the term 'cat's-eye amaurosis' to designate the disease which he supposed to give rise to this luminous appearance. Other observers had attributed it to a deficiency of pigment, still assuming that, in a state of health, the fundus of the eye must necessarily appear black.

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* In the first edition of the present Essay there was no special section on the Examination of the Eye. In now adding a preliminary chapter on the subject, I have here and there made use of a paragraph from my little volume on *Eye Diseases.* When I have had to repeat former statements, I have not thought it necessary to vary the wording merely for the sake of giving an air of novelty to some commonplace directions.

† *Medico-Chirurgical Transactions,* 1846.

The first ophthalmoscope was invented by Helmholtz, and described by him in a tract published in 1851.* He began by showing in how simple a manner, by using a slip of glass, the surface of the retina might be made visible; and then constructed an apparatus of several superimposed glass plates, with which he obtained a more perfect view of it. These first examinations were made without any artificial dilatation of the pupil, so that only a limited extent of the retina could be seen. He was able, however, to distinguish the optic nerve, and the vessels emerging from it.

In 1852 Ruete † invented an ophthalmoscope on a different principle from that of Helmholtz, light being thrown into the patient's eye by means of a concave mirror, through a hole in the centre of which the observer looked directly upon the illuminated retina. The practical objection to Ruete's instrument consisted in its being fixed to a stand, and therefore ill adapted to observe an organ so frequently in motion as the eye. Coccius ‡ avoided this inconvenience by constructing a small perforated mirror, to be held in the hand; and this instrument was still further modified by Anagnostakis,§ whose ophthalmoscope, from its extreme simplicity, appears to me one of the most useful that has yet been invented, and quite the best for the student to begin with. It consists of a circular glass mirror about an inch and three-quarters in diameter, slightly concave, and perforated in the centre with a round hole, the tenth of an inch wide. The mirror is set in a metal frame, to which a handle is fixed. Liebreich's instrument is made, not of glass but of polished metal, with a focus of from four to six inches. One of the advantages of the metallic mirror is that the edge of the aperture can be made quite thin, whereas the glass mirror must be backed by a plate of metal, and by drilling through this, and through the thickness of the glass, the aperture really becomes a short tube. Any reflection from the wall of this tubular aperture must be prevented, by carefully covering it with a dead black coating. At the back of Liebreich's instrument there is a little hinged clip for holding a convex or concave glass against the sight-hole. The concave glass is necessary in making an examination by the 'direct' method, if the patient or the observer be myopic.

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* *Beschreibung eines Augenspiegels zur Untersuchung der Netzhaut im lebenden Auge*, Berlin.

† *Der Augenspiegel und das Optometer*, Göttingen.

‡ *Ueber die Anwendung des Augenspiegels*, Leipzig, 1853.

§ *Essai sur l'Exploration de la Rétine et des Milieux de l'Œil sur le Vivant*, Paris, 1854.

There are various forms of the ophthalmoscope which, in the hands of practised observers, will afford a good view of the fundus of the eye, but it is well for the student to begin with the simplest kind; those, for instance, which I have just mentioned. When habit has given dexterity in the combined management of the mirror and object-lens, the *binocular* ophthalmoscope, as invented by Giraud-Teulon, or some improved form of it, may be employed.

Before commencing a thorough examination of a case, it is necessary to dilate the pupil with atropine, unless it has become permanently dilated from disease. In many instances, however, a glance at the optic nerve and the parts adjacent is all that is required, and in that case it is unnecessary to subject the patient to the inconvenience of atropine.

The observer and the patient sit face to face in a room from which daylight is excluded; the only source of illumination being a lamp, or, still better, a jet of gas issuing from a jointed tube, so that the flame can be placed higher or lower, according to the height of the patient's head. The flame should be on a level with his eye, and just far enough behind him to prevent any of the direct rays falling on his cornea. The chimney surrounding the flame must be of transparent glass, and, if faintly tinged with blue, it will modify the red rays, and impart to them a whiteness nearly resembling that of ordinary daylight. The observer places the back of the mirror close to his own eye, so that he looks through the central aperture, and holds the instrument at such an angle that the reflected light from it falls into the patient's pupil. This is always very difficult for a beginner to accomplish, but a little practice soon makes it easy. He will know that he holds the instrument in the right position and at a proper distance from the eye, by seeing the fundus assume a brilliant reddish appearance.

Still holding the ophthalmoscope in the same position, he takes in the other hand a convex glass, of two inches or two inches and a half focus, and places it a little in front of the cornea. If the fundus of the eye be properly illuminated, and the convex glass correctly placed, some of the retinal vessels will now be distinctly seen. The observer is often confused by seeing a small bright image of the mirror reflected from the surface of the object-lens. This image can be got rid of by giving to the lens a slight inclination.

By turning the eye in various directions every portion of the retina is successively brought under the view of the observer. The necessity for varying the position of the eye constitutes a great objection to the more complicated ophthalmoscopes, which are fixed to a table or other support; and some eyes are so unsteady, and so little under the patient's control, that the observer is obliged to follow their movements by slight changes in the position of the ophthalmoscope, which can only be effected when the instrument is held in the hand.

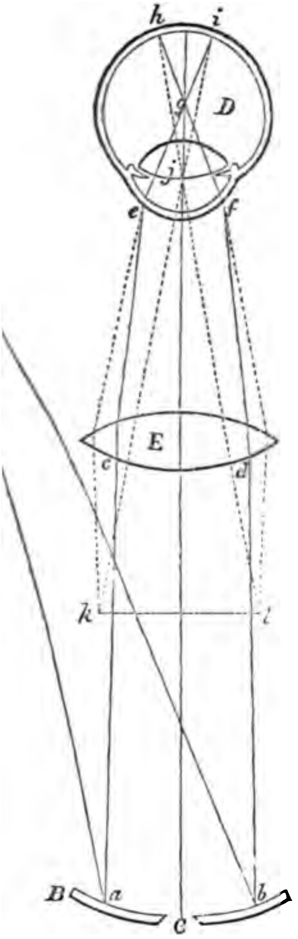
There are two methods of examining with the ophthalmoscope—the 'direct,' and the 'indirect.' In the former method, the mirror must be brought very close to the patient's eye—an inch or two from the cornea—and the image of the retina then appears to the observer in its natural *erect* position. But this very close approximation to the patient is inconvenient; the side of the patient's head intercepts some of the light which ought to fall on the mirror; and only a limited portion of the retina, thus feebly illuminated, can be brought into view at one time. The direct method, therefore, is comparatively seldom employed, and chiefly for the purpose of examining in detail small portions of the fundus, which are seen in their true position, and considerably magnified.

In the 'indirect' method, the mirror is held at a distance of several inches from the patient's eye, and a convex lens of short focus, two to two and a half inches, is placed a little in front of the cornea. In this way the inconvenient and obviously undesirable relative position of the observer and observed is avoided, the retina is more brilliantly illuminated than in the 'direct' method, and a good general view of the whole fundus is obtained. The image of the retina seen by the observer is an 'aërial' one, which is formed at a point between the convex lens and the ophthalmoscope, appearing there in an *inverted* position. This inversion of the parts examined must always be in mind by the surgeon while employing the 'indirect' d.

following diagram, copied from Zander's work, explains de in which the aërial inverted image is formed.

hin the narrow limits of the present essay, I cannot pt to give more than a bare outline of the use of the almoscope. The literature of the subject is already overming. One of the most complete treatises is that by Zander, lluded to, *Der Augenspiegel*; Leipzig, 1859. It has been lated, and has undergone considerable condensation—

FIG. 143.



A is the illuminating flame; *B* the concave speculum; *C* the aperture in its centre; *D* the patient's eye, before which is held a convex lens, *E*. From the flame *A* the rays *a b* fall on the speculum, and are reflected from it towards *D*. Striking the lens, *E*, at *c* and *d*, they acquire a greater convergence in passing through it, and fall upon the cornea at *e* and *f*. Traversing the patient's eye, they again converge, and, intersecting at *g*, form on the retina a 'circle of dispersion,' at *h i*. Reflected from the retina, in the direction of the dotted lines, *h*, *j*, *i*, *j*, they pass out of the eye, and being intercepted by the lens *E*, are again refracted, and form at *k l* an inverted image of the retinal surface *h i*, which is viewed by the observer's eye placed at *C*.

a process it greatly needed—by Carter, under the title of *The Ophthalmoscope, its Varieties and its Use*; 1864. There is also an excellent essay in French by Giraud-Teulon, contributed by him to the supplemental volume of Testelin's and Warlomont's translation of Mackenzie's great work.

Ophthalmoscopic Appearances of the Eye in a healthy state.
(Plate I. fig. 1.)

In the heading of this section I use the word 'healthy' with a certain latitude of meaning; for, apart from any serious disease, the mere advance of age imprints upon the internal tissues of the eye, certain changes of appearance, which, although deviating from an ideal standard of perfect health, can hardly be termed morbid. At present, I wish to present to the reader merely a sketch of what he is to look for in an eye which fairly performs its functions as an organ of vision.

Retina.—The observer must not expect to find this tissue presenting one uniform colour in all cases; the tint varies from pale red, through shades of red-orange and yellow-orange, to buff. In full-blooded persons, with a vigorous circulation, the retina would naturally have a much redder appearance than in those who are feeble and anæmic.* The colour of the retina is almost wholly due to the vascular choroid behind it; and the amount of redness transmitted from the choroid will depend upon the quantity and condition of the hexagonal pigment between it and the retina. Some ophthalmoscopists altogether object to our speaking of the colour of the retina, inasmuch as owing to its translucency, it allows the redness of the choroid to be seen. But no objection ought surely to be taken on this account to our familiarly applying the term colour to the retina itself.

Across the illuminated fundus of the eye the observer will notice large vessels radiating from a central point towards the periphery. These are the large branches of the central artery and vein of the retina; and by directing the patient to turn the eye a little towards the median plane, the observer will be able to trace these vessels to their parent trunks in the middle of the optic nerve. The vessels of the choroid, as I shall by-and-by have occasion to notice, are so entirely unlike the radiating trunks of the retina, that a single examination will suffice to prevent any subsequent confusion between them.

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* These remarks apply only to patients as commonly seen in England. Among the darker tribes of mankind, the abundance of pigment gives to the fundus of the eye, both in health and in disease, shades of colour wholly different from those of the fairer races. For ophthalmoscopic appearances among the natives of India, see Macnamara's *Lectures on Diseases of the Eye*, 1866.

It requires a little more practice to distinguish between the retinal arteries and the veins. If an arterial trunk be examined where it attains its greatest size, namely, at its emergence from the optic nerve, it will be seen to be of a paler red colour than the adjacent vein, and to present a double outline. The greater thickness of the arterial wall is the cause of both these peculiarities of appearance; for, of course, the colour of the contained blood is less plainly seen where the wall is thicker; and while the light, reflected from behind the artery, shines through it with subdued brightness, each side of the cylinder presents a line of shadow. The coats of the veins, on the other hand, are so thin, that they allow the colour of the blood to be plainly seen throughout the whole diameter of the tube. This distinction between the veins and the arteries of the retina becomes less marked as age advances. Simple inspection of a healthy eye does not detect any pulsation in the retinal vessels; but if the globe is firmly pressed with the finger, a decided pulsation may be seen, both in the arteries and veins.

If the patient looks directly forwards, a very important portion of the retina comes into view, namely, that occupied by the *macula lutea*, or 'yellow spot,' which corresponds to the axis of vision. The retinal arteries and veins deviate a little from their regularly radiating course as they approach the yellow spot, which therefore has no large vessel in its immediate neighbourhood. (Plate I. fig. 1.) Most observers, I think, must content themselves with making out the cloudy redness which indicates the position of the *macula lutea*, without actually seeing the dot which it forms. Liebreich gives a drawing (tab. ii. fig. 1) in which it is represented. I have, however, never succeeded in obtaining such a view of it as he depicts.

Optic nerve.—To bring the nerve into view, the patient must direct the eye a little towards the nose. No structure seen with the ophthalmoscope presents a greater variety of appearance than the optic nerve, even in patients who enjoy good sight. As age advances it becomes smaller, and often deviates more or less from that circular outline which one may assume as the healthy standard.*

Contrasted with the reddish tint of the surrounding retina, the nerve appears cream-coloured, or it sometimes presents that faint tinge of pinkish-grey which we are familiar with in the cineritious portion of the cerebral convolutions. The extreme edge of the disk is often of a less decided white than the central portion.

From the centre of the nerve the main trunks of the retinal artery and vein are seen emerging. Commonly each vessel issues as a single trunk, which then divides into branches, but sometimes the division into two or three trunks takes place before the vessels quit the substance of the nerve in which they are imbedded. In some cases the vessels pass off at once to their destination, in nearly straight, or slightly wavy lines, while in other cases they form several abrupt curves on the surface of the nerve before quitting it.

Choroid.—This structure exhibits a great variety of appearances under the ophthalmoscope. The distinctness with which it is seen depends upon the degree of transparency of the retina, and the condition of the hexagonal pigment-cells behind it; and it seems that considerable variations in both these tissues are compatible with good sight.

In young persons the vessels of the choroid appear dim and indistinct, as if overspread with a thin semi-opaque film; but in old persons they are sometimes so plainly seen that the observer almost forgets he is looking at them through the whole substance of the retina. It is in old persons, therefore, that the peculiar arrangement of the choroidal vessels can be best studied. They are very much larger than the radiating vessels of the retina, and are closely packed together, leaving between them narrow, elongated spaces, in which dark pigment is visible. (Plate III. fig. 1.) During the earlier periods of life these vessels present a bright red, but in old age this colour often becomes mixed with a brownish tint.

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* I have uniformly spoken of the *optic nerve*, instead of using the term 'optic papilla,' which some authors employ. No confusion can arise from applying the term *nerve* to that which is in reality only a part of the nerve, since no other portion than its extremity comes under our notice in using the ophthalmoscope. The term 'papilla' is objectionable too, as implying a *prominence*; and I believe the distal end of the optic nerve to be nearly, if not quite plane in a state of health.

CHAPTER III.

DISEASES OF THE CONJUNCTIVA AND ITS AREOLAR TISSUE.

(*Ophthalmia*; *Conjunctivitis.*)

INFLAMMATION of the conjunctiva, I need hardly say, accompanies many of the inflammatory processes originating in other tissues of the eyeball. In the present chapter I confine myself to those cases in which the inflammation originates in the conjunctiva, and is either limited to it, or spreads only to the sclerotic.

Inflammatory redness differs very remarkably in these two structures. It is on the inner surface of the lids, and at their point of junction with the globe, that the conjunctival vessels are largest, and their redness is most strongly marked; and the colour becomes paler as the vessels diminish in size on approaching the cornea. The sclerotic vessels, on the contrary, are most visible close to the cornea, around which they form a pink circle, known as the *sclerotic zone*—a very characteristic mark of several important forms of disease in the deep-seated tissues of the eye. Even if the sclerotic be uniformly injected throughout its whole extent, this injection cannot be traced very far back from the edge of the cornea, because the redness soon becomes hidden beneath the fibrous insertions of the recti muscles. The vessels of the sclerotic are small, closely set together, and so interlaced with the proper fibres of the part that the individual trunks cannot be recognised; they merely produce the effect of a uniform tint of colour, nearly resembling that of carmine. The conjunctival vessels, for the most part, are plainly seen, and, except in that high stage of inflammation termed *chemosis*, they can be observed repeatedly to anastomose, so as to form a closely-set network.

Elaborate classifications of the various forms of ophthalmia are to be found in many of the systematic works on eye-diseases; but minute distinctions, however plausible they may look on paper, are of little or no use to the practitioner. In selecting a few heads, under which to group the varieties of ophthalmia, I have been guided by the very decided peculiarities which certain forms present, or by the marked difference in the treatment they require. Most of the slighter forms of conjunctival redness, not resulting from direct violence or the presence of foreign bodies, are due to atmospheric changes; and the cases described by authors under the name *simple ophthalmia*, are, for the most part, mild cases of catarrhal inflammation. When the sclerotic also is affected, the term *rheumatic* is sometimes added; and Mackenzie uses the words 'catarrho-rheumatic' to signify that both the conjunctiva and the sclerotic are inflamed, although the inflammation may be due to the mere external agency of cold, and not to the presence of rheumatic poison in the blood of the patient.

Slight attacks of redness of the conjunctiva are commonly attended with only trifling uneasiness. The enlarged vessels, projecting above the level of the membrane, suggest to the patient the notion of foreign bodies, sand or dust, between the lids and the globe. But in other instances, where the redness is very trifling, the pain is of a neuralgic character, and it is for the irritation existing in the ophthalmic division of the fifth nerve that the patient seeks medical aid. It is important for the practitioner to remember that in such cases the suffering may be really severe, although there is far less appearance of inflammation than in other cases where pain can hardly be said to exist.

Whenever a case of ophthalmia is seen for the first time, the margins of the lids and the puncta lacrymalia should be carefully explored, as a few irregular eyelashes, or even a single eyelash lodged in one of the puncta, may be causing the irritation.

It sometimes happens that a foreign body, lodged under the upper lid, sets up a considerable amount of ophthalmia, and yet the patient is not aware of any such cause of irritation being present. To evert the lid requires a certain amount of tact and practice. A probe, or the feather-end of a pen, just thick enough to resist bending, is to be laid horizontally across the lid, about half an inch from its free margin. The surgeon then grasps with his finger and thumb the eyelashes growing from the middle of the tarsus, and draws the lid away from the globe, while at the same moment he slightly depresses the probe or pen, and tells the patient to look downwards. The tarsal cartilage tilts over, and the conjunctival surface of the lid is exposed to view. The foreign body is almost invariably found within a line or two of the tarsal margin.

This simple eversion of the lid appears so obvious a method of detecting foreign bodies, that one fancies it must have suggested itself to surgeons from the very earliest period; and yet, as far as I can discover, it was for the first time made public by Ware, in 1787.*

When the surgeon has satisfied himself that the redness of the conjunctiva is not caused or kept up by any mechanical irritation, he is not at once to prescribe a lotion or drops as a mere matter of routine. I shall hereafter have occasion to speak of the invaluable properties of a local stimulant in cases of true *catarrhal ophthalmia*; but at present I am considering those varying forms of conjunctival redness which are described by most writers under the name of *simple ophthalmia*. It is the surgeon's business to note well the general aspect of the patient: to ascertain what is faulty in respect of digestion, general nervous power, condition of the circulation; whether the ophthalmia can be traced to over-use of the eyes, exposure to irritating or vitiated air, want of exercise, excess in the use of stimulants, tobacco, &c.; in short, a rapid survey is to be taken of whatever is faulty in the patient's general health, and, in most cases, when this has been done, and the proper medical and dietetic means have been taken to correct what is amiss, the ophthalmia is already in a fair way of being cured.

As a rule, local congestion of the conjunctival vessels is met with in feeble and languid patients, who require tonics—iron, or quinine, or mineral acids, and a corresponding plan of diet. Of course there are many cases in which an excess of stimulants, and general over-feeding, have disturbed the due balance of the patient's circulation, and where a restricted and well-regulated diet is absolutely essential. But even in such cases a careful and moderate use of tonics is often necessary. What I wish to guard my readers against is the habit, which has been handed down to us from early times, of regarding all inflammations of the eye as necessarily to be treated by depletion, leeches, and low diet. The very reverse of this is the truth. The popular notion that a leech or two to the temples, and a purgative, must needs cut short an attack of inflammation in the eye is shared by only too many of the old school of practitioners. In young children especially such treatment is most mischievous. From the age of one or two years up to puberty, ulceration of the cornea is what we have most to fear, and this is sometimes attended with so slight a degree of redness of the conjunctiva and sclerotic, that it is important for the surgeon to be aware of this fact, and not to overlook slight attacks of ophthalmia in such subjects, but in every case to look carefully to the condition of the cornea.

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* *Remarks on the Ophthalmy*, &c. p. 23.—I have thought it well to repeat, in this place, directions already given under another head, at p. 17.

While I so strongly insist on the great importance of general treatment in ophthalmia, I by no means exclude the use of local remedies. Where much intolerance of light exists, a small blister to the temple, or the application of tincture of iodine to the skin of the upper lid, will often afford great and immediate relief. Bathing the eyes night and morning with warm water is of great use in some irritable patients; while, in other cases the use of cold water is indicated. Those persons especially who have induced a congested state of the conjunctival vessels by prolonged exposure to artificial light, are often greatly relieved by a plentiful sluicing of the closed lids with cold water night and morning. Where there is agglutination of the lids during sleep, a little spermaceti, or perfectly fresh olive-oil, may be smeared on the eyelashes at bedtime. Weak solutions of acetate of lead or alum (two, three, or four grains to an ounce of distilled water) are useful in chronic cases; but they should be used sparingly, and never for too long a time. After a few days they should be left off, and the part allowed to recover its natural tone, the stimulant being resumed if necessary; but it should never be uninterruptedly continued for weeks or even months, as patients are only too fond of doing.

There are certain forms of ophthalmia which present such distinctive characteristics that they are very properly known by special names. Such are the *Catarrhal*, the *Purulent* (including the *Infantile* and the *Gonorrhœal* forms), the *Pustular*, and the *Chronic*. The disease commonly termed *Scrofulous Ophthalmia* should rather be classed among the diseases of the cornea; and the same may be said of the *Exanthematous* ophthalmia of authors; for it is the cornea which chiefly suffers, either by ulceration or sloughing, in consequence of the low state of vitality following the various forms of exanthematous disease. The term chronic, although of course applicable to any slow and protracted form of disease, when applied to ophthalmia is usually understood to mean an affection of the palpebral conjunctiva, the caruncle and semilunar fold, and the margin of the lids, which is either developed as an independent disease, or remains as a sequela of an acute attack of catarrhal or purulent inflammation.

CATARRHAL OPHTHALMIA.

This is commonly caused by exposure to draughts of cold air, but it is by no means limited to the cold season of the year. It frequently attacks large numbers of persons during the extreme heat of July or August, especially if, as often happens, an east wind prevails at the same time.

A well-marked case of catarrhal ophthalmia presents the following appearances: the cornea is quite clear, and vision is unimpaired, or only occasionally obstructed by the passage of thickened mucus across the area of the pupil. The conjunctiva of the lids is redder than natural, and the injection is particularly marked at the point of reflection of the conjunctiva from the lower lid to the globe. The semilunar fold and caruncle are red and much swollen, especially the former, and this enlargement of the semilunar fold often remains long after all other traces of the ophthalmia have subsided. The surface of the globe presents a network of vessels which gradually becomes less marked as it approaches the cornea. In some cases the sclerotic is involved, and then the peculiar pink zone is seen reaching close up to the margin of the cornea.

A peculiar characteristic of true catarrhal ophthalmia is the existence of numerous red blotches at various parts of the network of vessels, caused by some of these having given way and allowed their blood to become extravasated. The extravasations vary much in size; some are as small as a pin's head, others almost equal the breadth of the cornea.

At the commencement of the attack there is little increase of secretion; subsequently, mucous secretion sets in, which in some cases becomes so profuse as to make the surgeon suspect that the case may be one of true purulent ophthalmia.

There is usually no acute pain in common catarrhal inflammation; but a sense of weight and stiffness in the lids, and, as the disease advances, the enlargement of the vessels suggests to the patient the notion of sand or some other foreign substance between the lids and the globe.

When the sclerotic is much involved, there is usually intolerance of light, and much secretion of tears, and pain either of a dull aching or of an acute darting character. The upper lid, too, frequently becomes œdematous in cases of this mixed kind of sclerotic and conjunctival inflammation, and the infiltration of the subconjunctival cellular tissue raises the conjunctiva above the level of the cornea, so as even sometimes to overlap its margin. This elevated condition of the inflamed conjunctiva is termed *Chemosis*.

I need hardly say that a patient who is the subject of catarrhal ophthalmia is frequently disordered in general health, with confined bowels and disturbed digestive functions, and may require appropriate treatment by internal medicines; but very often the ophthalmia comes on without any general ailment, and seems a purely local affection, even limiting itself in some instances to one eye.

Treatment.—When the ophthalmia is unattended with constitutional disturbance, and is confined to the conjunctiva, the local application of nitrate of silver in solution may be regarded almost as a specific. It should be used in the proportion of two grains to the ounce of distilled water, and dropped upon the surface of the eye twice or thrice a day, the conjunctiva being cleansed, by bathing it with warm water, before each application of the drops. At bedtime the eyelashes should be anointed with a little spermaceti-ointment or olive-oil. Care must be taken not to continue the use of the drops too long. After being used for a week, they may be omitted for a couple of days, and then resumed as before, if the inflammation appears unsubdued; but often it will be sufficient, after a week's application as above described, to use the drops for a few days longer once a day. In uncomplicated cases, ten days or a fortnight will suffice for the cure; but, if the disease spreads to the sclerotic and cornea, the nitrate of silver must be omitted. The caruncle and semilunar fold are the last to recover their healthy condition after an attack of catarrhal ophthalmia. I have said that the treatment by nitrate of silver is to be adopted when the inflammation is *limited to the conjunctiva*; and it is from want of attention to this point that so much mischief is constantly done. Whenever the sclerotic is much inflamed, and, still more, whenever the cornea is in the least degree implicated, nitrate of silver does nothing but harm.

PUSTULAR OPHTHALMIA.

This is a very common form of ophthalmia, especially among children and young persons. It is characterised by little, reddish,* aphtha-like elevations on the conjunctiva, close to the edge of the cornea, each surrounded by a plexus of blood-vessels. The centre of the little elevations is less vascular, and therefore whiter, than the base, and hence their appearance is a good deal like that of a pustule; but they do not contain pus, and the term 'papular ophthalmia' would be more appropriate than 'pustular.' When only one or two of these so-called 'pustules' are present, they are usually found upon the equator of the eyeball; but sometimes they are more numerous, and almost surround the cornea. They are seldom attended with much pain, or intolerance of light, unless the sclerotic be also inflamed. In true pustular ophthalmia the cornea never suffers, although, from the redness extending close up to its margin, patients are often alarmed at the prospect of the disease affecting the sight.

Vascular elevations similar to those of common pustular ophthalmia sometimes accompany the irritable form of corneal inflammation improperly termed 'Scrofulous Ophthalmia.' In such cases the intolerance of light may be very great.

Unless there be some derangement of the general health, the treatment of pustular ophthalmia is very simple. A weak solution of acetate of lead—two, three, or four grains to the ounce of distilled water—may be used twice or thrice a day; or, if the inflammation be extensive, and the 'pustules' numerous, a blister to the temple should be applied before the lotion is resorted to.

PURULENT OPHTHALMIA.

(*Suppurative Ophthalmia; Ophthalmo-blenorrhœa; Conjunctivitis puro-mucosa; Ophthalmia contagiosa; Egyptian Ophthalmia; Ophthalmia bellica; Military Ophthalmia.*)

On arriving at the consideration of this form of ophthalmia, we must no longer confine our attention to the conjunctiva; for although it is in this tissue that the disease commences, it derives all its importance from the fact that the *cornea* is liable to become involved. Much has been written upon the essential differences subsisting between the common purulent ophthalmia of adults, that affecting infants, the Egyptian, and the gonorrhœal ophthalmia; but these various forms, in certain stages of their progress, often resemble each other very closely, so that a severe case of common purulent ophthalmia cannot be distinguished from one of gonorrhœal origin: and the purulent secretion from the eye of an infant suffering from *ophthalmia neonatorum*, if applied to the eye of an adult, may set up all the phenomena of the truly gonorrhœal form. We must not expect, therefore, to be able in every instance to say with certainty, the first time a patient comes before us, 'This is simple purulent ophthalmia;' or, 'This is of gonorrhœal origin;' we must wait until we have had time to watch the progress of the case.

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* It was termed by Morgan 'Aphthous Ophthalmia.'

If a patient presents himself in an early stage of purulent ophthalmia, we may, as I have said, be unable to distinguish the disease from the simple catarrhal form; but should the purulent ophthalmia have reached its height, we should find the following appearances.

The patient is generally pale and depressed; the lids are of a dull red, inclining to purple; they are swollen and œdematous, often to such an extent as to prevent the patient separating their margins in the smallest degree. When the surgeon draws them apart, thick yellow secretion oozes from the conjunctival surface, and if allowed to dry, forms a crust, which almost hides the eyelashes from view. The inability to open the eyes very naturally induces the patient to believe that he is blind, and this belief tends still further to depress him both in body and mind. To separate the lids, to cleanse the cornea from the secretion which overspreads it, and thus to give the patient a glimpse of surrounding objects, is often the best means of raising his general powers.

In a case of extreme inflammation, such as I am now describing, the conjunctiva covering the globe is reddened, infiltrated with serum, and raised to a considerable extent above the surface of the sclerotic. This is especially the case immediately around the cornea, the conjunctiva being thrown up into a roll which overlaps the corneal margin. This raised condition of the inflamed conjunctiva constitutes what is termed *chemosis*—a very characteristic mark in this and other forms of severe inflammation. In exploring the surface of the cornea, the surgeon should not content himself with merely cleansing it from secretion by means of a bit of wetted lint or sponge; but with a probe or little spatula he should carefully lift up the overlapping portion of the chemosis, in search of any hidden ulcer; for it is at the extreme edge of the cornea that the ulceration sets in, which may eventually go on to perforation.

The milder cases of purulent ophthalmia stop short of the ulcerative stage; and under appropriate treatment the puriform secretion ceases, the conjunctiva gradually loses its unnatural vascularity, and regains its healthy aspect.

The severer cases terminate either in *ulceration* or *slough* of the cornea. The ulceration usually begins, as I have said, at the corneal margin, and as it extends assumes the form of a more or less deep crescentic groove. Then the ulcer perforates the cornea at some point, and a portion of iris prolapses, producing the appearance of a small dark-coloured nodule at the bottom of the ulcer.

Of course any protrusion of the iris must cause deformity of the pupil, which becomes pear-shaped, oval, or reduced to a narrow slit, in proportion to the amount of iris which has escaped through the ulcer. Sometimes the ulceration spreads as a deep groove quite around the margin of the cornea, so as to isolate its central portion, which stands out in relief, cloudy or wholly opaque. Eventually this central portion becomes involved in the ulcerative process, and then the whole cornea becomes thinned, so as to yield to the pressure of the contents of the globe, and forms a bulging mass made up of the remains of the corneal tissue, between the fibres of which dark-coloured portions of exposed iris protrude. At a later period the surface becomes traversed by ramifying blood-vessels. This wholesale destruction of the cornea, however, rarely occurs except in cases of gonorrhœal inflammation. Sometimes purulent ophthalmia, instead of inducing ulceration, ends in *sloughing*. In that case the chemosed conjunctiva encroaches a good deal upon the surface of the cornea; the latter becomes hazy, then opaque and yellowish, and quite dull on the surface; at last it looks almost like a piece of wash-leather, then softens and comes away in shreds; the whole iris bulges forwards, and becomes coated with a fibrous exudation, which eventually transforms the part into a *staphyloma*.

Purulent ophthalmia can undoubtedly be transferred from one person to another by contact with the secretion. Patients, therefore should be cautioned on this point, as also their nurses or attendants. It seems probable that in hot countries, where this ophthalmia is very prevalent, the flies act as propagators of the disease. The dust also of those countries, by keeping the conjunctiva in a state of chronic irritation, no doubt predisposes to the attack. In England the disease, like the common catarrhal form, is, I think, most frequent during the extreme heat which sometimes visits us in July or August, if it be attended, as is often the case, with an east wind.

Treatment.—Although the more rational practice of the present day has effected a vast reform in the treatment of so-called inflammatory diseases, both internal and external, the force of old prejudice and habit has, to a great extent, prevented medical men from applying the same reasoning and common sense to the treatment of eye-diseases which they apply to those of other organs of the body. And, indeed, if a practitioner, unaccustomed to meet with ophthalmic cases, turns in his difficulty to many a work of high authority, published in his own day, he finds such a system of depletion recommended for purulent ophthalmia as is positively frightful.

Purulent ophthalmia, in its severe form, is usually met with in patients who are irritable, pale, and depressed. And this is almost certain to be the case if the disease be seen at an advanced stage; for the popular notion of the disease, and indeed, of nearly all diseases of the eye, is, that depletion of every kind is the only way to combat them. So true is it, that the vulgar errors of to-day are but the solemn medical dicta of our forefathers.

If the patient's bowels have been well relieved, the first requisite is usually a narcotic at bedtime. I almost always give tincture of hyoscyamus, ♏xxv. or ʒss. or even ʒj. in camphor-mixture, unless the patient has been habituated to the use of opium, when a moderate dose of that drug may be preferable. It is not easy to lay down positive rules for diet, but it should be such as is best calculated to keep the patient's vital powers to the level of ordinary health; as much of plain nutritious food being taken as the stomach can digest, and just such an amount of stimulants as will aid digestion, and maintain the due vigour of the circulation. Quinine is almost always useful in suitable doses. In short, ulceration and sloughing of the cornea should be combated or guarded against, just on the same principles as those destructive processes would be combated in any other tissue of the body. To a delicate, ill-fed, over-worked woman, attacked with acute purulent ophthalmia, it may be necessary, in addition to a little beer at her dinner, to order a glass of wine twice or thrice a day. To a person in a comfortable position in life, the ordinary amount of stimulants may be amply sufficient, while, with one habitually intemperate, a considerable diminution of the accustomed quantity may really effect the desired object, by avoiding that after-depression of the nervous system which invariably follows over-indulgence in drink.

The local treatment of purulent ophthalmia consists in the frequent employment of astringents, such as alum, nitrate of silver, or tannin, dissolved in distilled water. The alum may be used in the proportion of eight or ten grains to the ounce, and applied by means of a fine soft rag, every hour during the day, and as often during the night as is compatible with the patient's rest. Where the surface of the globe can be well exposed by drawing down the lower lid, it may suffice to dab the surface of the palpebral conjunctiva and to squeeze the lotion over the surface of the eye from the rag or a fine sponge. If there be so much swelling of the lids as to make it impossible to expose the surface of the globe, the lotion must be injected beneath the lids with a syringe, first throwing in a little warm water to clear away the discharge. As the case improves, the lotion may be used less frequently, every two or three hours. If nitrate of silver be employed, it should be in the proportion of three or four grains to the ounce, and be dropped upon the surface of the globe three or four times a day, after syringing away the discharge with a little warm water. Tannin dissolved in distilled water may be used as a substitute for the alum. In some severe cases which assume the violence of the gonorrhœal form, ulceration rapidly extends along the edge of the cornea—usually the lower edge—in the form of a deep crescentic groove. Unless speedily arrested, it penetrates the thickness of the cornea, and if the opening into the anterior chamber be large, so much of the iris may prolapse as greatly to diminish, or wholly to annihilate the pupillary aperture. In such cases it is sometimes possible to check the spread of the ulcer by rapidly passing over its entire surface a fine point of nitrate of silver. A fine probe, coated with the fused salt, is usually the best means of application.

I need hardly allude to the great importance of pure air in the disease now under our notice. In fine weather it is not necessary, even during the acute stage, wholly to confine the patient to the house; and when the ulceration is arrested, and the purulent discharge has ceased, careful and judicious change of air will tend more than anything else to remove the chronic ophthalmia, which is otherwise apt to linger on for a long period.

GONORRHŒAL OPHTHALMIA.

This disease is essentially the same in character as the preceding; but is far more severe and destructive. It is caused by gonorrhœal matter coming in contact with the conjunctiva; and among the more ignorant classes it is sometimes the result of a very prevalent vulgar error—that a sovereign remedy for sore eyes is to bathe them in the patient's own urine.

I know of no symptom by which we can positively distinguish ordinary purulent ophthalmia from the gonorrhœal form, provided the two diseases are seen at an early stage. Many authors speak of gonorrhœal ophthalmia as almost invariably confining itself to one eye; but this is certainly not the case; and I could relate many instances in which both eyes were attacked within a few days of each other. Indeed, it seems strange that this is not the rule rather than the exception.

Gonorrhœal, like ordinary purulent ophthalmia, begins with redness of the conjunctiva, and a sensation of sand beneath the lids. After a few hours muco-purulent discharge sets in, and the ocular portion of the conjunctiva becomes infiltrated with serum. This thickening rapidly increases and forms a *chemosis*, which is always a very marked symptom in gonorrhœal cases. At the same time the lids become red, and so much swollen that the patient can separate them to only a very slight extent. The cornea becomes hazy; and at this stage an ulcer is almost certain to be found at its margin. Sometimes ulceration begins while the rest of the cornea is still clear; and in that case some care is necessary to detect the loss of substance. A thorough examination of an eye at this stage of the disease cannot be made without the aid of the wire speculum, which prevents the swollen conjunctiva of the lids from bulging over and hiding the cornea. If the margin of the cornea be overlapped by chemosis, a probe or little spatula should be used to hold it aside, while the surface of the extreme edge of the cornea is wiped perfectly clean with a bit of wetted lint or rag.

Patients affected with gonorrhœal ophthalmia are almost always in a state of depression, with weak pulse and deranged digestion. This condition is partly due to the local disease itself, and partly to the distress of mind caused by the fear of impending blindness. It seems extraordinary that surgeons of eminence can have been so far misled by theoretical notions about 'inflammation' as to have overlooked the general condition of these patients, and to have treated them by frightful bleedings, mercury carried to salivation, and other depressing means. Those of my readers who may imagine that the so-called 'antiphlogistic' plan of treating gonorrhœal or severe purulent ophthalmia belongs to the remote past, need only turn to the works of those who, thirty or forty years ago, were the great authorities of ophthalmic practice, to find that profuse bleeding, mercurialism, and a diet just stopping short of actual starvation, are enjoined as the best means of arresting ulceration and sloughing in the eye; while the very same authorities would have condemned, as *mala praxis*, such treatment of similar morbid processes in the arm or in the leg. One author tells us, that 'the *only case* of gonorrhœal ophthalmia he had seen in which the eye was saved was that of a young woman, in whom venesection was repeated as often as blood could be got from the arm. She lost 170 ounces of blood in a few days, and looked as if every drop of blood had been drained from her body, the skin having nearly the hue of a wax-candle.' One would have thought that the adage, *exceptio probat regulam*, would have occurred to this surgeon's mind, and that he would have regarded a system as self-condemned under which *only one* eye had escaped destruction. But he never seems to have had the slightest suspicion that the system could be wrong.

A second authority quotes, among other cases, the case of a young man who, on the first day, had been bled to fainting, then vomiting was kept up by tartar-emetic as long as it could be borne. In the evening, the pain in the eye had become worse; he was bled again. On the following morning the swelling of the lids was greatly increased, so that the eye could not be seen, and there was copious yellow discharge; the night had been passed in severe pain, which entirely prevented sleep. Bleeding was repeated twice more: blood was taken, by cupping, from the back of the neck and the temple, and leeches were applied around the eye in large numbers; 'but although the free use of purgatives and antimonials, with low diet, was combined with these measures, no sensible effect was produced in diminishing the violence of the inflammation, or arresting its progress.' Still no misgiving as to the soundness of the system! A third surgeon tells us, that 'the lancet must be hardly ever out of our reach; for if ever there was a disease in which blood may be taken away without limitation, it is this.' A still later authority, in a bulky text-book, written little more than thirty years ago, says: 'You will deem it necessary to bleed at the outset of the attack most freely; it would be almost criminal to stop the flow of blood until your patient exhibited symptoms of faintness; and as soon as he rallies, and the pain returns, the operation should be repeated until syncope is again produced. At the same time you would prescribe a liberal dose of calomel and jalap, so as to act freely on the bowels, and afterwards the tartarised antimony in sufficient quantity to maintain a state of decided nausea. You would also freely scarify the conjunctiva, . . . taking care to divide the texture of the conjunctiva at each sweep of the knife, so as to penetrate as far as the fluid effused into the subconjunctival cellular membrane. Bleeding from the conjunctiva is to be encouraged. A weak alum-lotion is to be used, and the diet is to be limited to light fluid aliment.' An injunction hardly necessary, since one cannot see how a man who has been kept in a state of perpetual nausea is to retain any food at all. But the patient is not to escape with only this amount of depletion. 'You would proceed to apply a quantity of leeches just below the tarsal margin of the lower eyelid, and direct the application of a blister between the scapulæ. Lastly, it may be necessary to use tonic and stimulating lotions, . . . and to employ a restorative regimen to reinvigorate the reduced powers'! Powers, be it observed, which have been reduced by the surgeon himself. We are to pull the house down, and then try to build it up again.

I may be told, that it is useless to bring forward such cases as these; that the current of medical opinion is changed, and that it now sets strongly against bleeding and depletion, and rather towards a tonic and stimulating plan of treating diseases. I am glad to acknowledge that such is the fact; but, by some strange fatality, the arguments which are allowed to apply to other diseases are still, to a certain extent, ignored so soon as diseases of the eye come to be treated. Some of the works from which I have quoted are still referred to by those who have only occasional opportunities of seeing cases of gonorrhœal founded upon the theory that the cornea perished by ing; that this sloughing was caused by fibrinous effusion th the conjunctiva immediately surrounding the cornea, by the vessels supplying the cornea were compressed, and irculation impeded. He assumed that the cornea derived hole of its nutrition through blood-vessels passing into it the conjunctiva, and quite ignored the fact of any vessels g to it from the sclerotic, and he would have utterly iated the notion of there being such a substance in the n body as a non-vascular tissue. The elevated roll of nctiva, constituting what is called the chemosis, was to he great source of danger, and this was to be freely d by means of radiating incisions, so as to allow the d fibrin to escape, and the vessels supplying the cornea to ieved from pressure. The anatomical mistake upon which ll's practice was founded was well exposed at the time harton Jones.

fact is, that the cornea, in severe cases of gonorrhœal almia, does not simply perish by sloughing, in the same s a tumour strangulated by a ligature perishes. Ulcera- rst attacks the extreme edge of the cornea, in the manner described at page 35, and extends in a crescentic form considerable portion of the cornea has been cut off from tritive supply, and then of course it loses its vitality. In cases, I have seen the ulceration extend all round the of the blood-vessels of the conjunctiva, with which there is generally associated a congestion of other more important tissues; but to reduce the patient's vital powers by bleeding, mercury, and low diet, and then to expect to save the cornea by cutting the conjunctiva, appears to be utterly irrational, and opposed to the first principles of physiology and common sense.

In speaking of purulent ophthalmia (page 36) I have anticipated the treatment of the gonorrhœal form. It is quite impossible to lay down positive rules as applicable to all cases. Each case becomes a study in itself, and according to the patient's constitution, habits, station of life, and previous treatment, must the surgeon modify his plan. To maintain the digestive functions, to administer suitable quantities of nourishment, to sustain the circulation at a proper point of vigour, neither unnaturally exciting it to hurried action, nor allowing it to flag, and so lead to local congestion of blood, and consequent deterioration of tissues—to secure as far as possible pure air at an equable temperature, to soothe the nervous system, and promote sleep by such mild narcotics as shall not confine the bowels or induce subsequent depression—such is the outline of the general treatment to be pursued.

The local applications I have already indicated at page 37, only I would lay still greater stress, in cases of gonorrhœal ophthalmia, upon the utility of nitrate of silver, applied in substance to the surface and edges of the crescentic ulcer. Unless this application be made with great care and neatness of hand, it may do more harm than good. A stick of nitrate of silver can hardly be pointed so sharply as to answer the purpose, and a fine probe, upon the end of which a small portion of the salt has been fixed by fusion, is to be preferred. The lids being held apart with a wire speculum, and the edge of the cornea having been wiped clean, the fine point of nitrate of silver is to be lightly passed over the whole surface of the ulcer. This application may require to be repeated after a couple of days, but should not be persevered in after the ulceration has ceased to spread.

In spite of all our efforts and care, it must frequently happen that cases of gonorrhœal ophthalmia terminate in loss of sight. For the disease often occurs in unhealthy subjects, weakened by intemperance and debauchery, and who, before they apply to a regular practitioner, have probably been in the hands of quacks, whose only remedy is mercury. Still, when we consider of what immense importance it may be to retain even a small portion of the cornea in a transparent condition—thereby enabling the surgeon at some future time to make an artificial pupil, and so rescue the patient from blindness—we ought never to give up a case of gonorrhœal ophthalmia so long as any portion of one cornea retains its vitality.

GRANULAR CONJUNCTIVA.

(*Granular Lids; Trachoma.*)

One of the most serious sequelæ of purulent ophthalmia, whether of the simple or the gonorrhœal form, is that condition of the conjunctiva termed 'granular,' involving a hazy and vascular state of the cornea. During the progress of purulent ophthalmia, the palpebral conjunctiva, when cleansed from secretion, appears villous; and, after the purulent discharge has ceased, this condition of the membrane goes on increasing, until its surface resembles that of a granulating ulcer. The so-called 'granulations,' however, are in reality the follicles and papillæ of the conjunctiva, enlarged by inflammatory deposits. The firmness and solidity of these 'granulations' vary much in different subjects. When hard, and of considerable size, they cause irritability and blinking of the lids, and lacrymation, and after a time the cornea, especially its upper half, becomes hazy, and is traversed by numerous large vessels, forming in some cases a complete network, and giving an almost fleshy aspect to the part (*pannus*).

Treatment.—The granulations were long since recognised as causing by their friction the chronic inflammation and vascularity of the cornea; and accordingly, a great variety of plans have at various times been adopted for removing the granulations, and restoring smoothness to the palpebral conjunctiva. Complete excision with the knife or scissors, the rapid action of escharotics, and the more gradual wasting by means of astringents, have all in turn been employed against granular lids.

Effectually to cut away the granulations requires such extensive removal of the palpebral conjunctiva as is likely to induce permanent curving of the tarsus and consequent entropion; and the same result may follow the free employment of nitrate of silver. The ordinary astringent lotions of alum, tannin, &c. are powerless in the more severe cases. I have seen much benefit from the acetate of lead, applied by dusting it, in fine powder, over the everted lid. This causes a good deal of pain at the time, but afterwards gives decided relief, apparently by mechanically filling up the interstices of the elevations, and so producing a smooth surface for the eyeball to move upon. The salt, as it slowly dissolves, seems also to exert an astringent effect upon the vessels of the enlarged follicles and papillæ, and so to diminish their bulk. But the most effectual means I have ever tried for removing granulations is the undiluted liquor potassæ, applied by dabbing it upon the everted lids, on which it seems to act by chemically saponifying and dissolving away the hypertrophied tissue. The application may be repeated at intervals of a few days; and six or seven weeks of this treatment will sometimes suffice to remove the granulations, and, at the same time, to restore a considerable degree of clearness to the cornea.

But, every now and then, cases are met with in which the cornea is so opaque, and so traversed by large blood-vessels, as to prevent useful vision, even when the granular state of the lids has been almost subdued. Such instances of opaque and vascular cornea follow severe purulent ophthalmia, especially the form so common in the East, and known to us as Egyptian ophthalmia. Cases of almost equal opacity are met with at our London hospitals, among the more destitute Irish patients. It appears that a very severe form of purulent ophthalmia is sometimes epidemic in certain districts of Ireland, rivalling in virulence the disease of tropical countries.*

Patients who have been a long time suffering from granular lids in a severe form are almost invariably out of health; often reduced by the violent courses of medicine they have undergone, and with the eyes in an irritable condition from long-continued use of caustic applications. To place such patients, if possible, in a pure and bracing air, and to improve their general health by suitable tonics, will be the first indications for treatment. Caustics and stimulants should be laid aside, and counter-irritation employed by means of small blisters to the temple, and tincture of iodine to the skin of the lids. In this way considerable improvement may be induced both in the condition of the lids and of the cornea; but there will still remain certain inveterate cases, incurable by any ordinary treatment, either local or general. They usually present a granular condition of the palpebral conjunctiva; this, however, may have been got rid of, or greatly subdued, by treatment; the characteristic sign, which makes the disease so formidable, is the haziness and vascularity of the cornea.

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* Power, in a pamphlet on the Egyptian Ophthalmia, published in 1803, describes a species of the same disease as being 'frequently prevalent among the Irish peasantry, and considered by them to be infectious.' See also a paper by Wilde in the *London Journal of Medical Science*, vol. iii. 1851.

We will suppose a case in which the granular condition of the lids has been partially or wholly cured, and the general health restored; but where, after exhausting every resource of his art, the surgeon still finds the patient's corneæ permanently opaque, and traversed in all directions by vessels, vision being limited to the mere recognition of large objects. There may be every reason to believe that the tissues of the eye posterior to the cornea still remain healthy, and yet the condition of the latter destroys all hope of good vision being regained.

For such desperate cases a seemingly desperate remedy—*inoculation*—has been proposed, consisting in the production of a fresh attack of purulent ophthalmia, by applying to the conjunctiva some morbid secretion from the eye of a patient suffering under the acute form of that disease.

This treatment was extensively tried in Germany several years ago, but seems to have fallen into disuse, and only of late to have been revived. Its advocates asserted that purulent ophthalmia, thus produced in an eye which had previously undergone the disease, would cause a wasting of the vessels overspreading the cornea, and ultimately restore its transparency. There seemed, however, a great risk of the second attack proving as severe as the first, and ending in destructive ulceration of the cornea; and the fact of the inoculation serving to keep up and perpetuate a dangerous and contagious disease, also operated with many surgeons as a reason for wholly discountenancing the practice. These considerations for some time induced me to abstain from the experiment. I had seen cases in which inoculation was followed by perforating ulcer of the cornea; but, at the same time, I had seen others in which considerable clearing of previously opaque corneæ took place without any ulceration whatever.

The first case in which I tried inoculation was one which seemed peculiarly suitable for it. The patient, a discharged soldier, was in good general health, but quite helpless in consequence of the state of his corneæ. They were so hazy that the position of his pupils could not be traced, and were traversed in every direction by vessels. He had perception of reflected light and colours, but could not distinguish a hand from a sheet of paper, except by the difference of tint. Although the granular state of the lids had been nearly subdued, the condition of the corneæ during three years had been proof against every mode of treatment.

Some pus from the eye of a patient with purulent ophthalmia was applied to each conjunctiva. Intense inflammation set in, and on the third day there was already chemosis with thick purulent discharge. A week later, both corneæ were so covered with a yellowish flocculent layer as to appear to be in a state of complete slough. This substance, however, in the course of a few days, had disappeared, and the corneæ were found to be entire, presenting a somewhat translucent aspect, although the chemosis and discharge still continued. As no local application except cold water was permitted, and no astringent used to control the discharge, it continued in a slight degree for some months. Meantime the corneæ, as they became clearer, presented but few traces of the vessels by which they had been so plentifully traversed. Six months after inoculation, the patient could recognise features at a distance of twelve feet, and with perfect security could go about the streets of London alone. There still remained such a degree of haziness about the centre of each cornea as prevented him from reading ordinary type, No. 16 of Jæger's specimens being the smallest characters he could readily make out.

I have since used inoculation repeatedly, and so many cases have been reported by others, that I should not have quoted this single case, except on account of its bearing upon a point which I think has not been sufficiently attended to, namely, the varying results of inoculation in respect of its inducing corneal ulceration.

The vitality of the cornea is put to a very severe test when the suppurative inflammation sets in with such intensity as is exemplified in the case just mentioned. If the cornea be abundantly supplied with blood by vessels traversing it in every direction, it will probably resist both ulceration and sloughing; whereas, a simply opaque and non-vascular cornea may be destroyed, or at least perforated, on account of mere deficiency of blood-supply. The abundant vessels which had prevented the cornea duly performing its function of transmitting light, serve to keep it alive while the inflammatory stage is going on, and so enable it eventually to recover its transparency and usefulness. The very circumstance, therefore, of the cornea being in a hyperæmic condition is favourable, as regards its ability to support the violent means employed for the restoration of its transparency.

Those who for the first time resort to inoculation in a case of corneal opacity, resulting from bygone purulent ophthalmia, will probably be dismayed when they witness the immediate result of their experiment; and will give up the cornea for lost when they see it overlapped and nearly hidden by chemosis, and catch a glimpse of its dead-yellow, slough-like surface. This, however, becomes detached, and leaves beneath it a translucent cornea, which, provided it has been well nourished with blood, may gradually advance in clearness, until it almost loses the marks of its former degeneration.

Throughout the treatment no attempt is to be made to arrest the discharge, cold water only being used as an external application in cleansing the eye. The patient should be allowed a nutritious diet, and on no account undergo depletion.

Even under the most favourable conditions, as regards the patient's general health, and the blood-supply of the cornea, inoculation must be a hazardous experiment; and it should, therefore, be reserved for those cases where the vascular opacity of the cornea has bidden defiance to all other forms of treatment, and has deprived the patient of all useful sight.

PURULENT OPHTHALMIA OF INFANTS.

(*Ophthalmia neonatorum.*)

This disease is closely allied in its symptoms to that just treated of, although not arising from the same specific form of infection.

Both diseases derive all their importance from the liability of the *cornea* to become ulcerated. The cause of *ophthalmia neonatorum* has given rise to much controversy; some regarding it as only an aggravated form of catarrhal ophthalmia, while others consider it as in every case due to contamination with the vaginal discharge of the mother. The latter is perhaps the more probable explanation, the difference in the intensity of the disease depending upon the more or less virulent nature of the discharge.

The ophthalmia begins a few days after birth. It may not for some time assume any intensity, and hence it is often overlooked in its early stage; and we are told that it did not begin till the child was two or three weeks old. When the child is jaundiced, the discharge assumes a deep yellow colour.

The surgeon's first object should be to ascertain to what extent the corneæ are involved. Having secured the infant's head between his knees, he should carefully introduce between the lids a wire speculum, of a size and strength of spring proportioned to the small palpebral opening of so young a child.

With a bit of moistened lint the discharge should be gently wiped away, so that the surface of the cornea may be thoroughly explored. If an ulcer exists, it will most commonly be found at the centre. It may occupy the whole area of the pupil, or involve all the cornea except its extreme edge, or the iris may be seen protruding through a complete perforation of the cornea in the form of a brownish nodule. If the whole cornea be destroyed, the iris will be seen bulging forward, covered by a thin glaze of semi-transparent inflammatory deposit. Sometimes it seems as if the posterior elastic lamina had resisted the ulcerative process, and still formed a thin coating to the bulging mass of iris. These are the cases which eventually exhibit *staphyloma*; the deposit upon the iris becoming by degrees thicker and denser, and assuming very much the appearance of opaque, or partially opaque, corneal tissue, over the surface of which, at a later period, arborescent vessels ramify. When the perforating ulcer of the cornea is very large, it not uncommonly happens that the lens escapes through the aperture

When the purulent ophthalmia is at its height, the lids are red and swollen; but when the cornea has given way, the bright rosy tint of the lids usually gives place to a dull livid colour, the swelling subsides, and the skin becomes flabby. The palpebral conjunctiva, when cleansed from the discharge, appears bright-red and villous.

Treatment.—The nutrition of an infant attacked with purulent ophthalmia is so important—as the means whereby the ulcerative process may be averted, or, if that process have already commenced, reparative material may be supplied for filling up the breach—that, before alluding to local treatment, I would insist upon the importance of the child being suckled, and not brought up by hand. A weakly infant, attacked with severe ulceration of the cornea, and fed with artificial food, has hardly a chance of recovery. Of course the condition of the bowels must be attended to; but care must be taken not to lower the child by unnecessary doses of 'grey powder'—that panacea for infantile complaints, according to popular belief. Weakly children are often benefited by a few drops — four or five—of Battley's liquor cinchonæ; given in a tea-spoonful of milk twice a day.

In the local treatment, all depressing and so-called 'antiphlogistic' measures are to be carefully avoided. Blistering is perfectly ineffectual towards controlling the discharge, and only weakens and irritates the general system. Abstraction of blood by leeches is even worse, as depriving the child of that reparative material which is so urgently required for averting or healing ulceration. I know of no application better than a solution of alum—five, eight, or ten grains to the ounce of distilled water—which should be injected between the lids every half-hour. It is well to inject a little warm water before using the alum-lotion, so as to wash away the discharge, and thus allow the alum to come completely into contact with the inflamed conjunctiva.

As the discharge abates, the lotion may be injected less frequently—every hour, or every two hours. Care must be taken not to chill the infant by wetting its clothes during the injecting.

The condition of the cornea must be carefully inspected from day to day. If there be a large ulcer, and the reparative process have set in, the surgeon must not be uneasy on observing that the surrounding portion of the cornea looks cloudy and reddish. This pink tinge is owing to the presence of blood-vessels, advancing towards the ulcer, and conveying to it reparative material. When the ulcer has become completely filled up, these blood-vessels will gradually disappear, and the peripheral portion of the cornea, in which they ramified, will resume its transparency.

Sometimes it is useful to change the local application, and to use a solution of nitrate of silver—two grains to the ounce—dropping a small quantity on the conjunctiva twice or thrice a day. This change of stimulus often acts beneficially, when the puriform discharge has almost ceased, and the ulcer still shows little disposition to heal. As soon as the ulcer begins to fill up rapidly, the alum or nitrate of silver should be used less frequently.

In severe cases of purulent ophthalmia, eversion of the swollen conjunctiva of the lids frequently occurs. This always gives rise to alarm among those who have charge of the child, and is often a cause of anxiety to the surgeon. It is a matter of no real importance; the eversion cannot be controlled by any artificial means, and is sure to cease as soon as the puriform discharge has abated.

'SCROFULOUS OR STRUMOUS OPHTHALMIA.'

(*Phlyctænular Ophthalmia*)

If by 'ophthalmia' we are to understand an inflammatory affection of the *conjunctiva*, this disease ought not to be termed ophthalmia at all. It is essentially a corneal disease, the conjunctiva being only secondarily affected, and I have therefore transferred it to the chapter in which Diseases of the Cornea are described.

CHRONIC OPHTHALMIA.

The acute stage of common catarrhal ophthalmia, if neglected, is apt to subside into a chronic form, characterised by a congested state of the palpebral conjunctiva with an increase in its mucous secretion, an unnatural fulness of the caruncle and semilunar fold, and some degree of redness along the tarsal edges. The patient complains of a sensation like that produced by a small foreign body beneath the lids; luminous bodies appear surrounded by a halo of prismatic colours; the eyes water when exposed to bright light or cold winds; and the lids are gummed together in the morning.

The surgeon, on first seeing such a case, should most carefully explore the edges of the tarsi, to see if any fine eyelashes are growing irregularly, so as to touch and irritate the globe. A single delicate hair, so fine as almost to elude observation, will sometimes suffice to keep up, or even of itself to produce, most of the symptoms I have just described.

Chronic ophthalmia, characterised by the above symptoms, is not always a sequela of acute inflammation. Indeed, it more commonly occurs as a primary disease, in persons whose occupations oblige them to sit for many hours in close and overheated rooms, while engaged on minute objects, especially under artificial light.

Treatment.—When we consider the various classes of persons liable to chronic ophthalmia, it is obviously impossible to lay down rules of treatment which shall be universally applicable. To rectify whatever may be found amiss in the general health, is the first indication. The injurious effects of artificial light chiefly depend upon the abundance of red rays inseparable from every form of it. These may be modified by adapting to the flame of the lamp, or gas-burner, a chimney or shade of transparent glass, slightly tinted with blue. The colour should be so faint as only just to whiten the flame, without imparting to it any decidedly blue tinge.

An immense variety of substances has been used in lotions and drops for the cure of this troublesome affection. Acetate of lead, alum, sulphate of zinc, nitrate of silver, sulphate of copper, tannin, &c., have all found their special admirers. Vinum opii was long a favourite form of drop; while the more homely washes of diluted brandy or vinegar have found favour as domestic remedies. Whatever form may be preferred, care should be taken not to make the solution too strong, and not to use it for too long a time without intermission. The object should be to stimulate the conjunctiva for a short period, and then to give it time to resume its natural functions. Many persons, by the habitual use of strong lotions, keep up the very condition they are seeking to cure. Acetate of lead, or alum, in the proportion of from two to four grains in the ounce of water, are perhaps as useful as any of the more common substances. Bathing the eyes in cold water, night and morning, is in many cases preferable to the use of any medicated lotions. An occasional small blister to the temple is useful when the eyes become suddenly irritable and intolerant of light.

INJURIES OF THE CONJUNCTIVA.

The more serious of these are due to contact with escharotics, heated fluids, or melted metal. Slight lacerations or cuts of the conjunctiva, not involving the sclerotic, require only very simple treatment—water-dressing and closure of the lids. Strong mineral acids, caustic alkalies, and other chemical substances, often produce the most destructive effects upon the conjunctiva and cornea, causing bands of adhesion to form between the lids and the globe, and inflicting upon the cornea such an amount of opacity as wholly to destroy sight. The damage in these cases is so instantaneous that the surgeon has hardly ever the opportunity of neutralising the destructive fluid. If at hand at the moment of the accident he would of course at once inject between the lids such a fluid as would chemically decompose the acid or caustic alkali, and form a neutral salt. Afterwards a little castor-oil or olive-oil may be dropped upon the surface of the globe, and water-dressing applied over the closed lids.

Where melted metal has spurted into the eye, the surgeon should always evert the upper lid, and explore all the folds of the conjunctiva; for large portions of metal will sometimes lodge beneath the lids in the most singular manner, and remain there quite unsuspected for a long time.

When lime, mortar, sand, or other solid matters, have been thrown against the eye, the upper lid must be everted, and every particle of grit removed in the most careful manner with a small scoop. In such cases it will not do to trust to injections of water only, although they may be useful after the scoop has done its work.

If the surface of the conjunctiva presents an opaque thickened appearance, as if it had been boiled, and the cornea is also of an opaque and pearly hue, the damage to sight is irreparable, and only slight improvement is to be hoped for. In such cases the surgeon must take care not to weaken the patient by bleeding or low diet, for it is by keeping up the patient's reparative power that the life of the corneal fibres is to be sustained, and sloughing averted. Where a portion of the cornea is densely white and opaque, and the rest only slightly cloudy, the latter part may recover much of its natural transparency.

In those cases where the opposed surfaces of the palpebral and ocular conjunctiva have sloughed, it is impossible to prevent the formation of bands of adhesion; but these may be somewhat limited by the frequent use of a probe, to break down the newly-formed granulations.

AFFECTIONS OF THE SUBCONJUNCTIVAL TISSUE.

ŒDEMA.

Pressure upon the trunk of the ophthalmic vein or its branches, by obstructing the return of blood from the conjunctiva and subjacent areolar tissue, is liable to produce œdema. In slight cases the œdema is confined to the lower part of the globe, where the distended conjunctiva sometimes overhangs the edge of the lower tarsus: it is only in extreme cases that the œdema extends to the upper part of the globe. In old persons, whose tissues are very lax, I have seen the margin of the cornea overlapped by the œdematous conjunctiva.

Œdema and chemosis only differ in degree; the former being a mere exudation of serum in consequence of pressure on the veins leading from the part, while the latter term is restricted to those cases where the conjunctiva and subjacent areolar tissue are actively inflamed. Abscess in the lids or in the lacrymal sac, tumours, and exostoses in the orbit, periosteal thickening in the neighbourhood of the ophthalmic vein—in short, any direct pressure on this vessel, may give rise to œdema, which cannot therefore be regarded as of itself constituting a disease, or as demanding attention, except as a symptom of something more important which has given rise to it.

ECCHYMOSIS.

Some of the small vessels beneath the conjunctiva may give way in consequence of a violent effort, such as coughing or vomiting, or sometimes without any assignable cause; in children with whooping cough such extravasation often takes place to a great extent. The blood may appear as a small patch on the white of the eye, or it may quite hide the sclerotic, and extend up to the edge of the cornea. The appearance is so peculiar that it can never be mistaken for inflammatory injection. In the latter the individual vessels can always be distinguished, while the extravasation presents the uniform aspect of a thinly spread-out clot.

Subconjunctival ecchymosis not uncommonly causes great alarm to the patient; but, except for its unsightliness, it is quite unimportant. The scraped root of the black bryony (*Tamus communis*) made into a poultice with bread crumbs or linseed meal, applied over the closed lids, and renewed every six hours, will hasten the absorption of blood. If this cannot be worn, frequent sluicing with cold water is the best thing to be done. Nothing, however, will cause the blood to be absorbed until after the lapse of several days.

PINGUECULA.

After the middle period of life, especially in persons who have been much exposed to the weather, or have lived in hot climates, it is very common to see small yellowish elevations on the sclerotic, close to the edge of the cornea, and on the equator of the eyeball. They are sometimes surrounded and traversed by a few fine vessels. When these little elevations attain their full size, they will be observed to have a somewhat triangular form, the base corresponding to the cornea. They have received the name of *pinguecula* from their being supposed to consist of fat; much of their bulk, however, is made up of fibrous tissue. Pingueculæ are growths so entirely harmless that they would not call for a remark, were it not that they very often give rise to the most serious alarm in the patient, who believes that they will gradually grow over the pupil and obstruct the sight. An explanation of their real nature comprises all that is required on the part of the surgeon.

PTERYGIUM.

This consists in a reddish, fleshy-looking growth extending from the semilunar fold to the cornea, the margin of which it frequently oversteps. It has a triangular shape, its base corresponding to the inner canthus. Slighter forms of this growth are met with, in which, instead of looking like a portion of muscle, the fibres are so thin and delicate as rather to resemble an aponeurosis with a few muscular fibres intermixed. No muscle, however, is found in these growths, which consist of fibrous tissue abundantly intermixed with blood-vessels.

Pterygium, like pinguecula, is found in persons past the middle period of life, and especially among those who have lived in tropical countries. The dust, which is there so abundant, may probably be an exciting cause. A very well-marked case came under my care in a mason and plasterer, who, although always residing in the neighbourhood of London, had of course been much exposed to dust of various kinds. The largest pterygium I ever saw, however, was in a countryman from Essex, in whom the apex of the growth, instead of stopping short of the area of the pupil, as is commonly the case, spread so far across the cornea as almost to hide the whole of the pupil. In this case I removed the growth; and whenever the apex extends so far as to occupy a large portion of the cornea, the deformity it produces may demand an operation. The lids being held asunder with a spring speculum, the lax portion covering the sclerotic is to be nipped up in a forceps, and cut across with a fine scalpel midway between the edge of the cornea and the semilunar fold. The portion extending towards the cornea may then be dissected off the sclerotic, great care being taken when that part is removed which adheres to the cornea. It is well not to remove the inner third of the pterygium, as otherwise the semilunar fold and caruncle are apt to retract, which afterwards gives an unpleasant prominence to the eyeball.

No other local treatment than removal with the knife or scissors is of any avail in getting rid of a pterygium. Stimulating lotions and drops only excite it to grow; and the varieties of pterygium described by authors, under the names of *sarcomatous*, *fungous*, *cancerous*, and *malignant*, were probably nothing more than common forms of the growth, irritated and teased by escharotics.

FATTY TUMOURS.

Fatty deposits to any large extent beneath the conjunctiva are uncommon. The few cases I have seen occurred in children, and the tumours all occupied the same position, namely, the line of reflection of the conjunctiva from the lower lid on to the globe. They extended from near the lower edge of the cornea to the outer canthus, were of an elongated form, almost resembling a haricot bean, and were partly concealed by the lower lid. On dividing the conjunctiva and the proper fibrous envelope, the fatty mass was easily turned out.

CYSTICERCUS TELÆ CELLULOSÆ.

This parasite is occasionally found in the subconjunctival cellular tissue, but it appears to be of very rare occurrence. I have seen but two instances, both in females, one patient being six, the other eighteen years old. The appearance was that of a rounded body, about as large as a pea, midway between the inner canthus and the cornea. There was a good deal of vascularity in the conjunctiva covering and surrounding it. In the first case a little watery bladder, rather larger than a pin's head, had been observed about eighteen months before the patient was brought to me. In the second case, no account could be given as to the first appearance of the growth. On the conjunctiva being divided, the cysticercus slipped out, and was at once recognised under the microscope. Sichel, in his *Iconographie*, gives a very good figure of a cysticercus in the position I have described (pl. lxxii. fig. 2), and also of one developed beneath the plica semilunaris (fig. 1). In other figures of the same plate, the animal is shown both in its natural size and magnified.*

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* Græfe mentions five cases of subconjunctival cysticercus as having occurred in his *clinique*, during a period of thirteen years. *Archiv für Ophthalmologie*, xii. 2, 174.

At the time I saw these two cases the connection between the development of tænia in the intestines, and of cysticercus in other parts of the body, had not been pointed out; nor was it suspected that two creatures so dissimilar were really the same animal under different forms of development.*

STAINS FROM NITRATE OF SILVER.

Before quitting the subject of affections of the conjunctiva and subjacent tissue, I may say a few words respecting the serious disfigurement which results from the prolonged use of nitrate of silver in solution. No surgeon who understands the real action of this substance—its invaluable efficacy in catarrhal ophthalmia, and its inutility or injurious effects in affections of the cornea—would be likely to employ it in such a manner as to produce permanent staining of the tissues of the eye; for in no case is its prolonged use of any service; the good it does, it does in a few days. Patients, however, have such unbounded faith in the efficacy of eye-drops and eye-waters, that they will frequently continue the use of them for months and even years.

One of the worst cases of staining with nitrate of silver I ever saw came under my notice only a short time ago. A woman, with incurable opacity at the centre of the cornea—the cicatrix of an ulcer, in fact—had been ordered to use drops of nitrate of silver. This she did for some months, under a surgeon's advice. She then went to another part of the country, but still continued the use of the drops, putting in, as she assured me, 'two drops every day for *ten years*.' The whole of her sclerotic was of a dirty sepia tint, most marked towards the lower part of the globe. The cornea itself slightly partook of the same tint, and the conjunctiva of the lower lid, thickened and vascular, looked as if a brush dipped in liquid sepia had been passed over it, the dull red colour of the conjunctiva being only seen where the membrane had formed a fold.

In another case, where this discoloration existed in a less marked degree than in the case just mentioned, I tried the effect of a solution of cyanide of potassium. The patient was an intelligent man, and could thoroughly understand the principle of the treatment, which was to keep the whole surface of stained tissue for a lengthened period in contact with the fluid. This was effected by the help of an 'eye-glass,' and I told the patient to draw down the lower lid, and to fix it against the cheek-bone with the rim of the glass, before throwing his head back. After several months but little benefit had resulted, and I then tried a solution of hyposulphite of soda, beginning with a strength of ten grains to the ounce of water—as the effect of the substance was unknown to me—and gradually increasing it up to a drachm to the ounce. The change effected was very slow, but when I last saw the patient the stain was barely traceable on close inspection.

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* See Küchenmeister, *On Animal and Vegetable Parasites of the Human Body*: and Von Siebold, *On Tape and Cystic Worms*; published by the Sydenham Society, 1857. See also the essay on PARASITES in the Appendix.

CHAPTER IV.

DISEASES OF THE CORNEA.

THOROUGHLY to appreciate the slight changes in the cornea which are capable of affecting the sight, the surgeon should clearly understand that the normal condition of the part consists in absolute transparency of its whole thickness, and perfect polish of its surface; every deviation from these conditions is an evidence of some morbid action.

When a healthy eye is examined near a window, the image of the window-frame ought to be depicted on the surface of the cornea with the most perfect sharpness and clearness of detail. A slight amount of inflammation, just enough to cause some thickening of the epithelium, destroys the brilliant polish, and causes the image of the window to appear blurred and dull, and the lines of the sash-bars crooked and wavy. This appearance is often important as giving notice that inflammation of other tissues of the eye may be going on; as in the early stage of Glaucoma, where this dull condition of the epithelium is always to be seen.

CONICAL CORNEA.

(*Hyperkeratosis*—the tissue of the cornea being erroneously supposed to be in excess; *Staphyloma corneæ pellucidum*; *Keratoconus*.)

This curious and rare* malformation consists in a change in the form of the cornea from a segment of a sphere to a cone, the transparency of the part remaining unaltered. There seems to be no peculiar constitution which predisposes to the affection. It is met with in both sexes; in persons apparently of good general health, as well as in the delicate and sickly: nor have I ever observed that any special employment, or mode of life, could be traced as the exciting cause.

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* That the disease is very rare may be seen by reference to a table which I contributed to the *London Journal of Medicine* (vol. ii. 1850), showing the number of cases of conical cornea occurring among the patients annually received at the Moorfields Hospital from 1819 to 1849.

The aspect of a patient with conical cornea is so peculiar, that when once seen, the affection can never afterwards be overlooked. The eye, viewed in front, has a brilliant and sparkling appearance, as if a tear were hanging just in front of the pupil. When seen in profile, the conical shape of the cornea is at once recognised. The position of the iris is unchanged, and its movements are perfectly natural; nor is any other tissue, except the cornea, observed to be affected. In saying that a conical cornea is perfectly transparent, I should modify the remark as far as concerns the extreme apex of the cone, which sometimes, when viewed closely, presents an appearance of slight opacity. In some cases this seems due to an actual haziness in the tissue itself; but the appearance is frequently caused by mere refraction of the rays of light. There seems no good reason for attributing this slight cloudiness of the apex of the cone to the friction of the lids.

The apex of the cone almost always corresponds to the centre of the cornea; but in very rare cases it has been observed to deviate from this position. The deformity usually begins when the patient is between twenty and thirty. At first he grows short-sighted, but as the change goes on, a remarkable refraction of the rays of light is produced; the flame of a candle appears surrounded with a halo, then it seems to be divided into a multitude of diverging rays, and sometimes, instead of a single flame, several flames are seen, arranged in a circle. When the last stage of conical deformity has been reached, the patient cannot read, even at the shortest focus.

In the few cases in which conical corneæ have been dissected, the apex of the cone has been found very much thinned. The mode in which the disease originates is at present quite unexplained; and in proportion to the obscurity which attends its cause have arisen the most varied suggestions for its treatment. Repeated evacuations of the aqueous humour, the same operation followed by pressure on the cornea, removal of the lens by extraction or solution, these, and perhaps other forms of operation, were formerly tried, but without benefit.

About thirty-three years ago, Tyrrell tried the effect of displacing the pupil towards the corneal margin. With the blunt hook he invented, he drew out a small piece of the iris, and cut it off, leaving a portion of the cut tissue entangled in the wound. His object was to bring the pupil opposite the flatter portion of the cone; but the result did not answer his expectations. A

osite side of the cornea. This operation, should, I think,
ted to those extreme cases of conical deformity which
be palliated by any optical contrivance.

t cases are sometimes benefited by deeply concave
; but in the complete stage of the disease, the sight is
at all, aided by glasses of any kind. A small aperture,
in-hole, in a metallic plate, held close to the eye, will in
ses of confirmed conical deformity enable a patient to
a focus of five or six inches, who previously had been
to discern a letter. If, instead of a hole, a slit about
uarters of an inch long and the thirtieth of an inch wide,
in a metallic plate fixed into a spectacle-frame, a con-
e extent of lateral vision is obtained, without any
y for moving the head in the way which is necessary
jects are viewed merely through a small circular aper-
t was the benefit derived from this slit in a metallic dia-
which suggested the operation of Iriodesis just described.

ineffectual have been the lotions, the drops, the escha-
hich have been used in every possible variety. Their
nent was justified by the expectation that local astrin-
ight induce contraction in the tissue of the cornea; and
failed to do this, they at least, if carefully used, could
arm to the patient's system. But a plan of treatment
ised some years ago, which appears to be so utterly
al, and is so fraught with mischief to the digestion and
health of the patient, that I cannot quit the present
without a few words of warning against it. The plan

and for nine years longer had taken the mixture at intervals. She was a martyr to dyspepsia, as might well be imagined, and utterly broken down in general health. Her corneæ remained conical.

ARCUS SENILIS.

This term is by no means well chosen, for the change in the cornea which it implies commences long before old age can be said to have arrived, and by the time the patient has reached the age of sixty or seventy, the arc has usually been converted into a complete circle. Several years ago, Canton described the appearance as being due to a fatty degeneration of the peripheral portion of the cornea; and the term 'arcus adiposus' would therefore be well applied to its early stage, and 'annulus adiposus' to that condition in which the white ring completely encircles the cornea. In many persons past forty years of age, in some even at a much earlier period, an opaque whitish crescent may be observed skirting the margin of the cornea, either at its upper or lower part. This opaque crescent is the commencement of the so-called 'arcus senilis;' and on close inspection it will be seen that the opacity is not an extension of the white tissue of the sclerotic into that of the cornea, but that a narrow interval of partially clear cornea always intervenes between the two opaque structures. In some old persons, the circle assumes a chalky whiteness, and presents a very striking appearance.

'Arcus senilis' is considered by some observers to indicate the co-existence of fatty degeneration of the heart. As far as the eye itself is concerned, the change can be considered as of very little importance. It certainly does not, as has been asserted, in any way contra-indicate the operation of cataract by extraction; for I have many times carried my section through a strongly-marked 'arcus senilis,' and the wound has become quickly and firmly united.

INFLAMMATION OF THE CORNEA.

(*Keratitis*; *Corneitis*. The former of these terms—from κερατίτης, horny—is undoubtedly preferable to *Corneitis*, which is neither Greek nor Latin.)

The healthy cornea, as I have already observed, is of the mos perfect transparency, and its surface smooth and brilliant in th highest degree. These qualities are lost as soon as the par becomes inflamed; a general haziness overspreads the whol structure, and the surface looks like a steamy glass.

If the inflammation be acute, a crescentic plexus of vessels will be seen passing from the edge of the cornea for some little distance—a line or more—into its substance. These vessels are so fine, and so closely set together, that they produce the appearance of a small patch of blood smeared upon the surface of the cornea. With a lens of an inch focus the individual vessels composing the plexus may be identified. This characteristic plexus sometimes involves a third or even a half of the corneal circumference.

A zone of pink vessels is always seen in the sclerotic adjacent to the cornea, whenever any form of active keratitis is present; this *sclerotic zone* also exists whenever the iris is inflamed. It is therefore always to be regarded as an important sign. As acute keratitis advances, some portion of the hazy cornea may become more decidedly opaque, and of a pale yellow tint; this shows that softening is going on, which may lead to actual giving way of the part. Intolerance of light and abundant secretion of tears accompany keratitis. The larger venous trunks of the conjunctiva become full and distended, but there is an absence of that fine vascular network in the conjunctiva which characterises ophthalmia.

One eye is usually attacked at a time, but the other may sooner or later become involved, and it very often happens that the second eye becomes inflamed just as the first is recovering.

Children and young persons are the most frequent subjects of keratitis, and the disease is rare after the age of twenty. The subjects of it are usually of a weakly, irritable constitution, often pale and anæmic; in some cases presenting the swollen cervical glands and other marks of scrofula.

The prognosis is favourable in proportion as the patient is young, and is seen at an early stage of the disease.

The mischievous and too common practice of keeping such patients confined to darkened rooms often induces a morbid irritability of the nervous system, and an intolerance of light, which is still farther aggravated by the irritating drops so unsparingly applied to eyes affected with corneal inflammation.

Under judicious management a case of keratitis occurring in a child may sometimes pass off without leaving a trace of opacity. But when the disease occurs after puberty, and is severe and obstinate, perfect transparency is hardly ever restored, and the cornea remains ever afterwards rather more convex than natural, and very faintly mottled with opacities and partially transparent interstices. These opacities resulting from long-continued keratitis, without ulceration, require to be thoroughly understood; for the surgeon who has not made himself familiar with their appearance will be sure to overrate the patient's powers of sight. It seems as if long-continued keratitis in patients who have passed childhood were attended with some peculiar change in the fibres of the cornea, whereby those portions which present only the slightest traces of opacity become, from irregular refraction of the rays of light, unable to transmit a clear and well-defined image of objects.

Treatment.—I have already alluded to the constitutional peculiarities commonly met with in patients who are the subjects of keratitis. They are in every way unfitted to endure the 'antiphlogistic' measures recommended in so many works on eye-diseases. The diet should be nutritious and abundant, but not given in such quantities as to oppress the stomach and impair digestion. Very young children are almost always better without beer or wine. The former should be given to older children once a-day if they have been accustomed to it; but wine can only be required by children suffering from extreme debility; in ordinary cases it hurries the circulation, and increases the general irritability of the nervous system. Of course the condition of the bowels is to be carefully attended to; and where the state of the biliary and other secretions may demand the use of mercury, an occasional dose of calomel—one or two grains, with or without a proportionate quantity of rhubarb—is to be given; but anything like a mercurial course is to be avoided. Iron is, of all substances, the most beneficial in cases of genuine keratitis, but it frequently fails in consequence of being given in too large doses, and for too long a time without any pause. The tinctura ferri sesquichloridi is the form I usually prefer, giving it invariably directly after food, or even during a meal, and in doses varying, according to age, from five to twelve drops twice a day. The syrupus ferri iodidi is sometimes useful. Occasionally, when the patient is feeble, ill-nourished, or of phthisical tendency, cod-liver oil may be given as well as the iron, or even, for a time, instead of it.

Counter-irritation, by means of small blisters to the temples, is often valuable in combating the intolerance of light; and tincture of iodine, applied to the skin of the lids, also conduces to the same end, and is preferable to blisters in patients of extreme delicacy of constitution.

Inflammation of the cornea is essentially a tedious disease, nd the surgeon must often wait patiently for weeks, and even nonths, before the transparency of the part is restored. Hence t will be seen how necessary it is to give the tonic medicines n small doses, such as the patient can go on with for a coniderable period, instead of attempting to conquer the disease t once by giving large doses, which cannot be persevered in vithout derangement of the stomach and liver.

Warm fomentations, night and morning, or steaming the yes over hot water, will usually be found to allay their irritaility; but all stimulating lotions and drops do harm.

How any one who has seen much ophthalmic practice can ecommend the application of solid nitrate of silver to the conunctiva in cases of keratitis, I cannot comprehend. The same ubstance in solution, and the sulphates of copper and zinc, are lso frequently employed, and sometimes the ointments of the itrate and nitrico-oxide of mercury are added, as if on purpose o increase the irritation already existing.

‘Scrofulous or Strumous Ophthalmia’ (so called).

At page 50 I have observed that the well-known disease comnonly called Scrofulous Ophthalmia (*Phlyctænular Ophthalmia* f Mackenzie) derives all its importance from the fact that the ornea is implicated; and I therefore proposed to separate the lisease from the group of conjunctival inflammations, to which lone the term ‘Ophthalmia’ strictly belongs, and to treat of it under the head of Inflammation of the Cornea.

It specially attacks children, but certainly is not always confined to those of scrofulous constitution; at least it is met with where there is no evidence of tubercular disease. The most striking symptom is extreme intolerance of light (*photophobia*), and general irritability of the eyes and of the whole system. The local affection of the cornea shows itself either in a small whitish elevation (*phlyctænula*), or an ulcer. In either case a long plexus of vessels runs from the corneal margin to the morbid spot. This long plexus or lash of vessels is quite diagnostic of the disease. It is sometimes seen when the rest of the cornea is almost clear, but more commonly there are several phlyctænulæ or ulcers, and the whole of the cornea is more or less hazy. The intolerance of light I have mentioned, as being characteristic of the disease, causes violent spasm of the orbicularis palpebrarum, which is increased when the surgeon makes any attempt to examine the eyes. The intolerance is often much increased by the too common but most injudicious practice of keeping the patients in dark rooms. After many hours of darkness, the sudden admission of light is of course extremely painful. If the intolerance is very great, or the child too young to be open to persuasion, the examination must be made by means of the wire speculum.

The pain caused by exposure to light is often out of all proportion to the extent of corneal disease. In some extreme cases the surgeon is surprised to find merely a small whitish elevation (*phlyctænula*), or an ulcer the size of a pin's head, with the characteristic streak of vessels reaching to it from the edge of an almost clear cornea.

In true cases of this form of keratitis there is hardly any increase in the mucous secretion from the conjunctiva, but the flow of tears is profuse, and they gush out each time the lids are separated. There is a more or less marked zone of vessels in the sclerotic immediately around the cornea, but no general redness of the globe, the chief increase of vascularity being due to distension of the larger veins of the conjunctiva. The lids are often raw and excoriated at the edges, and the outer commissure is inclined to crack and bleed. Swollen and fissured lips and alæ nasi, excoriations and cracks behind the ears, eczema on various parts of the face, and eruptions on the scalp, are occasionally found to accompany this disease of the eyes in the more severe and long-continued cases.

Treatment.—Both the skill and patience of the surgeon are often severely tried by these cases, especially if they have been neglected, or treated injudiciously, before coming into his hands. Long-continued doses of mercury, seclusion in dark rooms involving the loss of air and exercise, and too much of food and stimulants, are the common sources of unsuccess as regards general management, whilst the local application is too often just that which is most hurtful—namely, nitrate of silver.

Under the head of Catarrhal Ophthalmia I have spoken of the valuable properties of this substance in solution, in cases where the inflammation is limited to the conjunctiva; and I have also mentioned how beneficially the application of the solid nitrate acts in arresting the rapid ulceration of the cornea in purulent or gonorrhœal ophthalmia. But the too common practice of dropping-in a solution of the nitrate in cases where the cornea is attacked either with phlyctænulæ or ulcers, is most mischievous, and often prevents the cure of a case which in other respects may have been judiciously treated.

I have said that children attacked with this disease should by no means be shut up in dark rooms. Light is as essential to the health of animals as of plants, and all inconvenience from bright light can be averted by the use of a large shade, or in elder children a pair of tinted spectacles. Out of doors a blue or green veil may be added. Moderate exercise in the open air should be taken whenever the weather is mild and dry, and sea-air is generally the most desirable, provided the place selected be not too bleak and windy. I have alluded to the ill effects of too much food and stimulants; but in doing so, I would not be supposed to recommend low diet: on the contrary, there should be an abundance of nutritious, easily-digested food. My remark was directed against that pernicious practice of stuffing young children with more animal food than the stomach can properly digest, and over-exciting their irritable circulation with wine and beer, as if their disease could, as it were, be taken by storm and extinguished by mere eating and drinking. Of course there are exceptional instances of very weakly children who require a small quantity of wine; but, as a rule, beer is preferable at an early age, and to those unaccustomed to stimulants pure milk will often be found of far more service.

With respect to drugs, I know of nothing so useful as iron in cases of keratitis, whether attended with phlyctænulæ or ulcers. It may be given alone, or in combination with quinine, according to circumstances. The reason why iron is so often ineffectually prescribed in this disease and in many others, appears to me to be, that it is given in too large doses and at wrong times. The form I prefer is the tinctura ferri sesquichloridi, in doses of 5, 10, or 12 drops, twice or thrice a day, to children ranging from five to fifteen years of age. It is best taken in water, and always immediately after a meal. Weakly children may at the same time take with advantage cod-liver oil. Every fortnight or so the iron may be discontinued for a couple of days, and if the bowels have become confined, or the liver appear to be deranged, a mild aperient may then be taken, with half a grain, a grain, or two grains of calomel, according to age and constitution.

Of local applications none are so generally employed as blisters; and no doubt, when used judiciously, they are very serviceable in subduing that intolerance of light which is one of the most distressing features of the disease. But here again a great mistake is frequently made in applying blisters of too large a size, and without sufficiently discriminating between those constitutions that will and those that will not bear them.

In feeble anæmic subjects a blister, even of small size, will often produce considerable depression; and in very young children with irritable skin, will bring out a troublesome eczematous eruption. The best effect is produced by applying blisters the size of a shilling or a florin to the temple, allowing the part to heal quickly, and repeating the blister when the cuticle is reproduced at the end of a week or ten days. A more rapid form of counter-irritation is that produced by undiluted tincture of iodine, painted on the skin of the upper lid. This may be repeated as often as the skin recovers its natural condition.

The lids may be bathed night and morning with warm water, or the steam of hot water may be allowed to play against them, which avoids the mechanical irritation of rags or sponges.

Spermaceti-ointment, or fresh olive-oil, may be smeared along the eyelashes at bedtime. Lotions of acetate of lead, or alum, two or three grains to the ounce of water, are sometimes useful where there is on the cornea merely a small opaque patch (phlyctæna), with the characteristic lash of vessels running to it; but whenever an ulcer exists lead-lotions are improper, as the carbonate of lead, which is precipitated from them, is liable to form an insoluble white deposit in the cicatrix.

Leeches always do harm in cases of true keratitis with ulceration of the cornea. The barbarous proceeding termed 'scarification of the lids,' is, I hope, so nearly obsolete as not to require notice.

To get rid of the plexus of vessels running from the edge of the cornea to the phlyctænula or ulcer on its surface, it has been gravely proposed that the vessels should be cut across with a lancet. This is, indeed, beginning at the wrong end. '*Ubi stimulus, ibi affluxus*;' so long as an irritable patch of deposit, or an ulcer exists, so long will an irregular supply of blood be sent thither. Heal the ulcer, or get rid of the irritability of the cornea, by constitutional means, and the plexus of vessels will vanish.

The opacities remaining after a long-continued attack of scrofulous ophthalmia are, to a certain extent, permanent; that is to say, if they result from the healing of ulcers. But if the ulcer be superficial and the child very young, it is surprising to see how faint a trace remains in after-life, to mark the site of the cicatrix.

SYPHILITIC KERATITIS.

It is to the careful observations of Hutchinson, that we owe the true knowledge of this remarkable form of corneal inflammation. Not that he detected a disease which had never been seen before; on the contrary, it was in patients who might have been selected as affording typical specimens of 'strumous ophthalmia' that he first declared the morbid appearances to be due, not to scrofula, but to inherited syphilis. He named the disease 'chronic interstitial keratitis;' but I think we may fairly substitute the shorter term *syphilitic.* No confusion can arise from thus naming the disease, because there is no special form of corneal inflammation connected with acquired syphilis, the chronic interstitial form being met with exclusively as a sequela of an *inherited* taint.

The subjects of this form of keratitis are children and young persons from five to eighteen years of age, and most frequently it is an eldest child that comes under observation. The disease begins at the centre of one cornea, in the form of a diffused haziness, like that of ground glass. Very soon whitish dots appear in the midst of the haze, not on the surface, but in the very substance of the cornea. These dots generally run together, and thus increase the amount of central opacity. At first there is but little attendant vascularity of the sclerotic and conjunctiva, but as the central opacity becomes more marked, these tissues become reddened, and a fine plexus of vessels spreads on the cornea itself, and gradually pervades the opaque portion, affecting the upper and central part of the cornea in preference to its lower half. Throughout the whole course of the disease there is no tendency to ulceration.

Usually within about two months—or it may be much earlier —the other cornea begins to be affected, the disease commencing, as in the eye first attacked, by a central haziness.

The vascularity of the cornea, when the disease is at its height, is wholly unlike that which attends granular lids, and other chronic forms of keratitis. In the latter the vessels are large and superficial, whereas in the disease now under consideration they penetrate the cornea so deeply, and are so fine and closely set together, that the effect produced is that of a tissue infiltrated with blood.

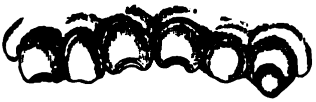
'In almost all cases the subjects of this keratitis,' says Hutchinson, 'present a very peculiar physiognomy, of which the most striking signs are, a coarse flabby skin, pits and scars on the face and forehead, cicatrices of old fissures at the angles of the mouth, sunken bridge to the nose, and a set of permanent teeth peculiar for their smallness, bad colour, and vertically notched edges.' He adds: 'As diagnostic of hereditary syphilis, various peculiarities are often presented by the other teeth, especially the canines, but the upper central incisors are the *test-teeth*. When first cut, these teeth are usually short, and the cutting edge is narrow from side to side, and very thin. After a while a crescentic portion from their edge breaks away, leaving a broad, shallow, vertical notch, which is permanent for some years, but between twenty and thirty usually becomes obliterated by the premature wearing down of the tooth.' . . . . . 'I have not met with a single example of well-characterised interstitial keratitis in which the teeth were of normal size and shape.'

More extensive experience has caused Mr. Hutchinson to modify this last remark, and he mentions several exceptional cases in which all the appearances of syphilitic keratitis were present, in association with well-formed teeth.

One very remarkable instance of keratitis—I think the severest I ever saw—occurred in my own practice, in a young lady whose teeth were quite remarkable for soundness and symmetry; but in her the peculiar physiognomy was well marked, and her history completely confirmed the fact of her inherited syphilis. I have also seen some striking cases, in which patients with well-formed features, and clear and ruddy complexions, had strongly-marked syphilitic keratitis; but their teeth were more or less affected. We therefore may meet with severe syphilitic keratitis in patients with healthy physiognomy and deformed teeth; or—still more rarely—in those with faultless teeth and the syphilitic cast of features; but to find the true form of keratitis in connection with both good teeth and good complexion also, is, I think, next to impossible.

I frequently notice that medical men who have not read Hutchinson's careful descriptions, but have only heard of 'notched teeth,' expect to find serrated edges, such as one so often sees in newly-cut healthy incisors. 'Serrated,' however, implies a series of notches. A single notch is that to which Hutchinson first drew attention; and the following figure, copied from his work, will at once show the reader what he is to look for.

FIG. 144.



In adults the notch often becomes worn away, but even then the tooth retains a characteristic shape. I liken it to that of a screw-driver, being wide at the base, where it joins the gum, and narrow at its cutting edge; while its lateral edges are thick and rounded. The lower incisors never lose their peculiar form, which is more or less cylindrical, and they are commonly wider apart than healthy teeth.

It must be always borne in mind that these syphilitic peculiarities in the teeth are only met with in the permanent set. The first set are not notched, but they are usually stunted and prone to premature decay.

Treatment.—A combined specific and tonic plan is advocated by Hutchinson, as being more efficacious than one exclusively tonic, and he advises the cautious use of mercurials and iodides. He prefers to administer the mercury by rubbing-in the milder ointment, always avoiding ptyalism, and gives internally iodide of potassium and iodide of iron.

I believe iron, under some form or other, to be the one drug needful. It should be given in small doses, because the cure is necessarily very slow, and the medicine must therefore be continued for many months. An occasional small dose of calomel—a grain or so once a fortnight—is requisite to prevent the iron deranging the liver, but I do not think 'a mercurial course,' as it is termed, either necessary or beneficial. The forms of iron I prefer are the tinctura ferri sesquichloridi, and syrup. ferri iodidi. For a young child six or seven years of age, eight or ten drops of the tincture, given once a day immediately after a meal, will be a full dose; each fortnight it may be left off for a day or two, and a grain of calomel given. Even for patients sixteen or eighteen years old, the dose of the tincture need never exceed fifteen or twenty drops.

Good diet, pure air, and all things calculated to improve the condition of the blood and tissues, are of the utmost importance in treating the cachectic subjects of inherited syphilis. The surgeon must ever bear in mind that the severer forms of syphilitic keratitis require a very long time for their cure. A bad case will require a year or even longer, and the friends of the patient ought at the very first to clearly understand this. A rapid cure is quite impossible. If only the vascularity of the cornea disappears, and from month to month the part becomes less opaque, the very worst case may terminate satisfactorily. It is, however, unreasonable to expect that in very severe cases absolute transparency of the cornea will ever be attained.

A very chronic kind of iritis commonly accompanies the severer forms of syphilitic keratitis, and the consequent deposits in the pupil, or around its margin, are first detected when the cornea is recovering its transparency.

Keratitis with Suppuration.

In simple inflammation of the cornea, the opacity, however dense it may be, consists of inflammatory exudation among the fibres of the part, without any destruction of the fibres themselves. Under certain conditions of the patient's system, however, the inflammation may run a very acute and rapid course, and within a few days terminate in suppuration or ulceration.

When suppuration takes place in the substance of the cornea, it is most frequently at the centre, or a little below that spot, that the pus collects. Its presence is usually manifested by a small yellowish patch in the midst of the general haziness. In very severe cases this yellow patch may rapidly spread, until the whole cornea assumes one uniform creamy tint, entirely hiding every trace of iris; the cornea then softens, and gives way at some part, the iris prolapses, and vision is eventually lost.

These are extreme cases: a more ordinary form of suppuration is that in which the pus gradually infiltrates the lower third, or even the lower half, of the cornea, and at last makes its way through the posterior elastic lamina, and then sinks down to the bottom of the anterior chamber, where it forms what is termed *hypopyon.*[*]

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[*] This collection of pus at the bottom of the anterior chamber is by some authors termed *onyx*; others use the latter word—now almost obsolete—to signify an abscess in the substance of the cornea.

The giving way of the posterior elastic lamina of the cornea is sometimes speedily followed by that of the anterior lamina, and in that case a perforation is established, through which a prolapsus of the iris takes place. This perforation of the cornea is followed by immediate relief of the severe pain which had existed as long as the pus was pent up among the fibres of the cornea, or in the anterior chamber. This pain is often severe to a degree quite incredible to those who have never witnessed such cases, assuming the form of neuralgia, and wholly preventing sleep.

Treatment.—In general surgery we are so accustomed, whenever an abscess forms, to regard its evacuation as the very first indication for treatment, that I may be expected to mention a puncture for giving exit to the pus, as the most important step in treating a case of suppuration in the cornea. But although it is common to speak of *abscess* in this part, the matter is not contained in a distinct cavity, but is infiltrated among the corneal fibres, so that if an incision be made, the pus does not flow out. The cornea, too, differs from every other superficial tissue of the body, in being transparent; and we should avoid inflicting any unnecessary wound, even to the smallest extent, upon a structure, the transparency of which is essential to sight.

The general tonic plan of treatment I have sketched out as suitable to cases of common keratitis will be applicable, with certain modifications, to keratitis with suppuration. We must take care not to reduce the patient's vital powers; for if we do, not only will the softening of the corneal tissue be likely to spread, but if perforation of the cornea takes place, there will be a deficiency of reparative material to fill up the breach, and a large prolapsus iridis, with consequent distortion or obliteration of the pupillary opening, will be the result.

In the very early stage of suppuration, when a small yellowish patch in the midst of the hazy cornea is all that is seen to mark the beginning of suppuration, blistering to the temple sometimes aids in checking the formation of pus; but when a considerable portion of the cornea has become infiltrated, and severe neuralgia sets in, blistering only aggravates the pain. Narcotics must then be given; to children, a few drops of tincture of hyoscyamus at bedtime; to adults, a fuller dose—ʒss. or ʒj. In very severe cases of neuralgia in the fifth nerve, hyoscyamus will be found unavailing, and morphia must be resorted to, especially if the patient be accustomed to the use of opium. Sometimes a piece of lint steeped in chloroform liniment, and laid upon the temple and forehead, over the region of the lacrymal and supraorbital branches of the fifth nerve, is of great service in lulling the pain.

If the infiltration and softening of the cornea go on to perforation, the aqueous humour at once drains away, and then the neuralgia usually ceases, or is mitigated in a remarkable degree. If the pain ceases, so as to allow the patient to obtain sleep without the aid of narcotics, they ought, as soon as possible, to be laid aside; for they almost invariably take away appetite, and the patient is now in need of good nourishment to hasten the repair of the breach in the cornea.

Bark and ammonia, or quinine, may be required at this stage of the disease; but a carefully-regulated nutritious diet, with a moderate amount of stimulants, must be the chief sources of the reparative process.

As respects local treatment, protection from light, and occasional fomentation with warm water or poppy-decoction, comprise all that is necessary during the earlier stage. When, however, the cornea has given way, the eyelids must be kept constantly closed, either by the application of a strip or two of plaster, or by means of a light pad of cotton-wool, arranged around the eyeball, and kept in its place by a bandage. The eye should only be opened occasionally by the surgeon, to ascertain the progress of repair. In some cases it is useful to abstain from examining the eye for four-and-twenty or eight-and-forty hours.

When prolapsus iridis has occurred, this occlusion of the eye is especially useful, as, by keeping the parts at rest, an opportunity is afforded for the adhesion of the protruded iris to the edges of the aperture in the cornea. As soon as this adhesion has taken place, no more iris can escape, and the prolapsed portion gradually shrinks, and flattens down to the level of the cicatrix. When, from want of vigour in the patient, the adhesive process is sluggish, it is sometimes useful lightly to touch the prolapsus with a point of nitrate of silver.

To attempt to return a portion of iris which has prolapsed through a loss of substance in the cornea, is utterly futile; for i will protrude again and again, so long as there exists an aper ture for it to escape through.

Disease of the fifth nerve, caused either by pressure on it trunk, as it is emerging by the side of the pons Varolii, or b primary degeneration in the tissue of the nerve itself, will give rise to a form of keratitis with suppuration very similar to that described in the preceding pages. In the cases of disease of the fifth nerve which I have seen, this affection of the cornea has not come on during the neuralgic stage, but at a later period, when, in consequence of partial or total destruction of the trunk of the nerve, there has been anæsthesia of the parts supplied by the ophthalmic division. In three or four cases which I have watched, the whole cornea was not destroyed; but after perforation had occurred, the process of softening ceased, and reparation so far took place that eventually there remained only an opaque cicatrix in the cornea, to which a portion of the iris adhered.*

'EXANTHEMATOUS OPHTHALMIA' (SO CALLED).

(*Post-febrile ulceration of the cornea; Ophthalmia morbillosa; Ophthalmia scarlatinosa; Ophthalmia variolcsa; Ophthalmia erysipelatosa.*)

The various forms of ophthalmia accompanying the exanthemata have been described by some authors with considerable minuteness; but if we restrict the term ophthalmia to signify an inflammation of the conjuctiva, it is perhaps in measles only that any very marked ophthalmia can be said to occur. Taking place, as it does, at the onset of the attack, it is one of the most marked symptoms of the disease, but demands no special treatment. The really important affection connected with measles, is the *ulceration of the cornea*, which results from the general debility produced by the disease. This ulceration is commonly attributable to a neglect of tonic treatment after the inflammatory symptoms have passed away. Iron and quinine, alone or in combination, cod-liver oil, the various influences of fresh air and nutritious diet, are all to be put in requisition to avert or to heal these ulcerations.

Scarlatina, on account of the greater exhaustion of the powers of life which it induces, is still more likely than measles to be followed by ulcers of the cornea. In some extreme cases of this frightful disease, the corneæ lose their vitality, and entirely slough away. The same system of tonics and nutritious diet which I have mentioned as useful in averting the sequelæ of measles, would be still more urgently called for after an attack of scarlatina.

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* In a paper published in the eighteenth volume of the *Medico-Chirurgical Transactions*, 1845, I drew attention to the fact, that anæsthesia of the fifth nerve was far more frequent on the *left* than on the right side. In 1857 I forwarded to the editors of the French translation of Mackenzie's *Treatise* (vol. ii. p. 763) a note containing all the literary references to cases of anæsthesia of the fifth nerve which I had collected up to that time. The result of the analysis of fifty-one cases is as follows: in five patients the fifth nerve was affected on both sides; in thirteen the right nerve only was affected; while thirty-three patients had anæsthesia of the *left* nerve.

During erysipelas of the head and face, in the severe form, the lids are so completely closed by the swelling of the skin, as to hide the eyes from observation. In the stage of debility succeeding the attack, ulceration of the cornea may arise, as in the two diseases above mentioned; or the cornea may even slough, as in scarlatina.

Of all the exanthemata, small-pox produces the greatest damage to the eyes: and a large proportion of those persons whom we see with shrunken globes, or with their corneæ converted into chalk-like ciatrices, have lost their sight from the ulceration induced by this disease. It was formerly supposed that these opacities were produced by pustules on the cornea itself; but it has been ascertained that pustules never form on this part, the opacities being invariably the result of ulcers, caused by the extreme prostration which succeeds the inflammatory stage.*

ULCERS OF THE CORNEA.

Under the various heads of *Purulent*, '*Scrofulous*,' and '*Exanthematous Ophthalmia*,' and in the section on *Keratitis*, I have mentioned the more formidable kinds of ulceration to which the cornea is liable. The cases, however, are very numerous in which corneal ulcers are developed in a more isolated manner than in any of the above mentioned diseases, being unattended with either purulent discharge from the conjunctiva, or general inflammation of the whole cornea.

Persons of all ages are liable to corneal ulceration. It is essentially a disease of debility, attacking those whose general power has been lowered by some exhausting illness, by bad or insufficient food, or some other depressing agency.

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* For this important fact we are indebted to the extended observations of Mr. Marson, at the Small-pox Hospital. He has lately published the results of his vast experience up to the present time. Among 15,000 cases of small-pox he has seen twenty-six instances of pustules on the eye-ball; but they have invariably appeared on the conjunctiva, never on the cornea.

In persons of feeble reparative power, an ulcer, instead of aling up to the level of the healthy cornea, sometimes forms slightly-depressed cicatrix. It is of course most important t to confound these two conditions, as is often done by those accustomed to the observation of eye-diseases. A recent er, in which the destructive process is still going on, presents harply-cut, well-defined edge, with little, if any, surrounding acity, and the excavation itself, as regards transparency, offers t little contrast to the sound cornea. An ulcer which is aling is always more or less opaque throughout, and there is cloudy halo surrounding it; and if the ulcer be large, vessels ill be seen running to it from the edge of the cornea. A pressed cicatrix, on the contrary, has its edges smoothly unded off, and its area is slightly opaque; there is little, if ny, cloudy halo surrounding it, and seldom any plexus of essels going to it from the corneal margin. In some cases, owever, a depressed cicatrix is supplied by a small vessel or wo, the remains of the plexus which once carried the material ecessary for the healing of the ulcer which preceded it.

If the progress of an ulcer be not arrested, it may eventually erforate the whole thickness of the cornea. The aqueous umour then escapes, the iris falls forwards, so that the anterior hamber becomes altogether obliterated, a portion of iris—large r small, according to the size of the perforation—protrudes hrough the opening, towards which also the pupil is displaced. f the prolapsus iridis be very large, the whole area of the pupil ay be annihilated.

In rare cases the ulceration stops short at the posterior lastic lamina of the cornea, which, in consequence of the pressure from behind, is thrust forwards as an almost transparent vesicle, filling up the cavity of the ulcer. The term *hernia corneæ* has been applied to this protrusion. It would at once be distinguished from a *prolapsus iridis* by the retention of the aqueous humour, and the consequent persistence of the anterior chamber.

There is one remarkable form of corneal ulceration—which I have seen only two or three times—of a singularly destructive and intractable character. In all of the cases the patients were men who appeared by no means debilitated, as far as their general health was concerned. One eye only was attacked; the ulceration commencing at the edge of the cornea, rapidly formed a deep crescentic groove, which continued to deepen and extend itself, until it had completely isolated the central portion of the cornea, which was left standing up in high relief. This central portion eventually yielded to the ulcerative process, and sight was of course entirely lost. It was remarkable that in all the cases the posterior lamina of the cornea either remained unbroken, or was perforated to only a small extent. The form of ulceration was very similar to that accompanying gonorrhœal ophthalmia; but there was no trace of purulent discharge. There was very little pain or uneasiness, and the amount of redness in the conjunctiva and sclerotic was but trifling. Probably some change in the tissue of the vessels supplying the globe was the cause of this rapid and uncontrollable ulceration.

Treatment.—I have said that corneal ulcers are almost always a result of general debility, and therefore their cure is to be sought rather by improving the general power of the patient than by local application. The exception to this rule is formed by those cases in which the ulcer is very large, exhibiting a total want of reparative action, and by those cases terminating in prolapse of the iris. In both of these instances, the local use of the solid nitrate of silver is often a very serviceable adjunct to the general treatment.

The mischievous effects of lead lotions, when applied to ulcers of the cornea, have been already alluded to (p. 66); and solutions of nitrate of silver, if used for too long a time, will also give rise to insoluble deposits, and consequent opacities.

While everything tending to improve the general health is to be resorted to in cases of ulceration, the occasional use of warm water to the eyes is commonly the best local application. The eye should be kept lightly covered; and if there be intolerance of light, or much pain in the eye, complete closure of the lids is indicated. This closure is especially necessary when either the iris has prolapsed, or a hernia corneæ has taken place.

I have already (p. 72) said how useless must be the attempt to push back a portion of iris protruding through a corneal ulcer. If the little nodule of iris soon becomes coated with an opaque layer of adhesive deposit, simple closure of the lids, and support of the general power by suitable diet and tonics, will suffice to cause the protruded iris to become adherent to the edge of the ulcer; after which, no further prolapse will occur. But if the protruding iris, instead of becoming coated with lymph, retains its natural colour and fibrous appearance, a touch with a fine int of nitrate of silver will often set up sufficient inflammation cause adhesive deposit to take place. In like manner the eep excavated ulcer, which sometimes forms in very anæmic nd weakly persons, and threatens to perforate the cornea, or to estroy it by rapidly spreading all around its margin, may be rrested, and a healing disposition given to it, by lightly passng the solid nitrate over the whole excavation and edges of the lcer.

OPACITIES OF THE CORNEA.

It is of the utmost importance as respects both prognosis and treatment, that the surgeon should make himself perfectly familiar with the varied appearances which corneal opacities assume. Without this knowledge, he will be constantly liable to deceive both himself and his patient, in promising the removal of opacities which are in their very nature permanent; or in pronouncing incurable, hazy conditions of the cornea, which, if promptly and skilfully treated, may be perfectly removed. To the latter class belong those cloudy opacities which I have described (p. 67) as overspreading the cornea in the slighter forms of simple keratitis. The short period, a few days or weeks, during which the cloudiness had existed, the presence of a vascular zone in the sclerotic, and some degree of irritability of the eye, would all point out the cloudiness of the cornea as being due to simple inflammatory deposit within its substance, which, under suitable treatment, may be so entirely dispersed as to leave the cornea in all its original transparency. If, on the other hand, the same amount of general haziness were known to have existed for a long time—say a year or more—if there were a total absence of sclerotic redness, and if the eye had long ceased to be irritable, the surgeon would know that the opaque condition of the cornea was incurable, and he would no longer attempt the use of stimulating lotions and ointments, which would only arouse fresh irritation and increase the existing mischief.

The haziness which sometimes remains after a severe and obstinate attack of keratitis, presents an appearance not easy to describe, but which the experience of a few cases will readily enable the surgeon to recognise again. There is a total absence of unnatural vascularity about the eye, but the whole cornea is slightly shaded with a faint haziness, with intervening spaces of almost transparent tissue, through which the colour and texture of the iris and the form of the pupil can be recognised, although not in their natural distinctness. The dimness of sight in these cases seems to be out of all proportion to the amount of opacity; and the patient can perhaps merely see black streaks when looking at a page of type.

The terms *nebula*, *albugo*, and *leucoma* have been applied to corneal opacities, according to their different degrees of density; the slighter forms being distinguished as *nebulæ ; albugo* and *leucoma* signifying rather the white opacity of cicatrices. The edge of a *nebula* is gradually shaded off into the surrounding clear tissue; that of a cicatrix, at least one of old standing, is more or less abruptly defined. Where a prolapse of the iris has taken place through a corneal ulcer, the leucoma which results is marked in the centre by a small blackish spot.

Treatment.—As regards the prognosis of nebulæ, their possible improvement mainly depends upon the age of the patient. In infancy, it is quite astonishing to see how the rapid interchange of material which is then going on, will diminish both the extent and the density of even large cicatrices. In an infant attacked with purulent ophthalmia, a cicatrix may at first be so large as to occupy the central third of the cornea, and yet, in after-life, a mere cloudy speck may remain opposite the centre of the pupil. At a later period of life, nebulæ, which form as the cicatrices of superficial ulcers, are more permanent; but around the denser part of the speck there is always a certain amount of cloudiness, which slowly disappears The older the nebula, the more sharply defined is its margin.

Allusion has already been made to the permanent white deposit which occurs in corneal ulcers, when lotions containing lead have been employed. The metal is deposited in the state of carbonate, and forms a chalky-white layer on the ulcerated surface. Practice alone can enable the surgeon to recognise these old lead-deposits. They somewhat resemble a little patch of whitewash, their margin being sharply defined, and their surface often presenting minute cracks, through which the tissue of the cornea appears as dark lines. When the ulcer has been very superfical, and the metallic deposit lies just beneath the epithelium, the surgeon may sometimes succeed in scraping away the deposit; to do this, however, requires the utmost care and lightness of hand.

A very curious form of *calcareous deposit*—phosphate or carbonate of lime—between the cornea and its epithelium some-is constantly going on in the human body, and which is ch more active in infancy and childhood than after the of growth has terminated. The lotions, the drops, the s, the ointments, which crowd the pages of the older lmic works, if not actually hurtful, as being likely to set h irritation, are either altogether inert or at best they o amuse the patient while time is slowly clearing the tissues.

INJURIES OF THE CORNEA.

sion.—The epithelium covering the anterior surface of nea is liable to be torn or scratched by coming in contact ny rough substance; or a little flap of the epithelium may tially detached and doubled down. Those who have not hese slight cases of injury to the epithelium cannot e how much pain they produce, especially in persons of a ve nervous system. A clean cut directly through the cornea auses far less pain than an abrasion of the epithelium so as to be scarcely discernible.

hin a short time after the epithelium has been injured, erotic is often much injected, and a profuse flow of tears every attempt to separate the lids. The surgeon will tain a view of the part by placing the patient in a chair tanding behind him. As soon as the lids are widely ted the pain almost ceases, and the surgeon must then

The *treatment* of these abrasions is very simple. A drop or two of olive-oil or castor-oil may be applied to the abraded surface, and then the lids are to be kept closed with a light pad of cotton-wool, and a bandage, for four-and-twenty hours. As soon as the epithelium is regenerated all irritation ceases, and the uniform polish of the cornea is restored.

Contusion of the cornea.—Blows on the cornea which do not cut or lacerate, but merely bruise, its tissue, vary greatly in their results, according to the violence of the blow, and the age and vigour of the patient. In the severer forms of contusion softening and suppuration among the fibres of the cornea wi probably occur, and the part will afterwards exhibit more or les haziness. But in very feeble or old persons, the whole corne may become softened and infiltrated with pus, and in such cas the pain is often very severe.

At length the cornea gives way, the aqueous humour escap and the pain immediately subsides; but the whole or the great part of the cornea becomes pulpy and disintegrated, and com away in shreds, and ultimately the globe shrinks, or else staphyloma is formed. The worst cases of this kind occ among paupers engaged in stone-breaking. During such wor a pair of gauze-wire goggles should always be worn.

Treatment.—Even a slight contusion, if it takes effect at t centre of the cornea, must be regarded as a serious accident, account of the suppuration and consequent haziness that m possibly ensue. We must take care, therefore, not to redu the patient by bleeding and mercury, since by so doing t vitality of the cornea is lowered, and softening and suppurati are more likely to take place. An eye which has received blow on the cornea should be kept closed and defended fro light, and poppy fomentation may be used, if any pain com on. If the case be seen early, a blister to the temple is som times useful as a counter-irritant. A narcotic may be requir at bedtime; and the diet should not be reduced below th which is suited to the patient's ordinary condition.

The setting-in of suppuration, attended as it is with pai would require an increased dose of the narcotic; and should t cornea give way, a tonic treatment, with a suitable proporti of stimulants, would become necessary, to limit the destructi of tissue, and afford material for repair.

Incised and punctured wounds.—Although cuts of the cornea are usually produced by sharp-edged or pointed bodies, they also occasionally result from sudden blows inflicted with blunt ones; and a smart stroke with a stick will sometimes inflict on the cornea a cut as clean as if made with a knife. Wounds of this latter description, however, on account of the shock given to the whole eye, are usually much more serious than those made with sharp instruments. A wound involving one-half of the corneal margin, such for instance as is made in the operation of extraction, may become completely united within three or four days, without inflammation occurring in any other tissue of the eyeball, whilst a much smaller cut produced by a blow with a stick or stone will be followed by severe and long-continued inflammation, ending in complete disorganisation of the globe. Small sharp bodies, such as fragments of metal or glass, when driven with great force and rapidity against the cornea, frequently produce so small a wound, that a surgeon unaccustomed to see such cases may be apt to underrate the size of the foreign body which has inflicted the injury; the elasticity of the corneal tissue causing the wound to contract as soon as the foreign body has passed through. When a case of this kind is seen immediately after the injury, the most careful scrutiny, with all the advantages of a good light, is often required to enable the surgeon to detect the wound. The whole surface of the iris, and especially the bottom of the anterior chamber, should be most carefully examined, in order to detect the lodgment of the penetrating body; and if the cornea be still transparent, and the aqueous humour retained, the pupil may be dilated with atropine, and the lens and deeper tissues explored with the ophthalmoscope. If any portion of the penetrating body protrude from the wound, it should be at once extracted with a fine well-closing forceps, the lids being held apart with a spring speculum, and the globe steadied by nipping up a fold of the conjunctiva covering the sclerotic.

When the wound of the cornea is large, a portion of the iris is frequently forced through the wound. If such a case is seen within a few hours of the accident, and before there has been time enough for the protruded iris to become united to the margins of the corneal wound by adhesive deposit, the portion of iris may sometimes be returned by careful pressure with a probe or small spatula. If, however, adhesion between the cornea and iris has already taken place, this reduction is impossible; and the surgeon must then content himself with maintaining the parts in perfect rest by keeping the lids closed; or if the protruding and strangulated iris be indisposed to shrink, it may be lightly touched with nitrate of silver, and the lids again kept closed for some hours.

Sometimes the protruded portion of iris gradually becomes distended with aqueous humour, and assumes a rounded pouch-like form. This little pouch should be freely punctured, or a portion of it cut off with curved scissors, and then the nitrate of silver and the bandage applied as before.

The advice I have here given, as to returning the iris protruding through an incised wound of the cornea, may at first appear to be inconsistent with what I have before said, at page 72; but the difference between the two cases consists in this—that when an ulcer has perforated the cornea, there is an actual loss of its substance, and if the iris protruding through such an aperture be pushed back, it will escape again and again. But in the case of an incised wound there is no loss of corneal tissue, merely a separation of its fibres; and if the protruding iris be returned into the anterior chamber, the elasticity of the corneal tissue will bring the edges of the wound into apposition, and keep them so until they have become united.

Punctured wounds of the cornea vary much in their character, accordingly as they are inflicted by means of pointed bodies of a large size, or by such small fragments as remain embedded among the fibres of the part. Wounds of the former class frequently involve other parts of the eye, and penetrate through the cornea into the iris or the lens. These complicated injuries cause either iritis or cataract, and will be spoken of in future chapters.

The simplest and by far the most common form of puncture of the cornea is that which happens when little fragments of metal or grit are forcibly projected against the eye, and remain sticking either in the epithelium or in the superficial layer of the cornea itself. Engineers, metal-turners, mill-stone dressers, stokers, are constantly liable to these injuries; and the surgeon should be able at once to remove the foreign body without inflicting in the attempt any farther injury on the cornea. Standing behind the patient, who should be seated opposite a window, the surgeon raises the upper lid by placing the tips of his first and second fingers against the edge of the tarsus, beneath the cilia, and then pressing the lid upwards and backwards without everting it; he then with these two fingers the globe by gentle pressure just above the cornea, ie point of the ring-finger gently presses the globe at its de. In the other hand he holds a little spatula-shaped ent (which for want of a better name I have called '), the flat end of which he passes under the foreign id so tilts it out. The point of a cataract-needle or a on account of its fineness and delicacy, is very unsuit- extracting these little bodies. All the treatment y after their removal consists in keeping the eye closed y or so, with perhaps occasional fomentation.

elongated chip of metal strikes the eye obliquely, it ies wedges itself into the cornea at about the middle of rness, lying exposed to view, but so completely buried fford no hold to a forceps. The surgeon must with ct-knife or cutting-needle slit up the layer of corneal ce along the whole length of the foreign body, which n be turned out without difficulty.

f the injuries most difficult to treat is that inflicted by -pointed chip of metal just long enough to transfix the and to thrust its point into the anterior chamber, while r extremity is so much embedded as to offer no hold for s. If the surgeon attempts to dig out such a chip, he ost certainly drive it farther in, until at last it slips into the anterior chamber, and entangles itself among es of the iris.

emoval of the foreign body will call for all the operator's d patience, and chloroform must be used if the patient d and unsteady. The lids being separated with the speculum, an assistant fixes the globe by nipping up forceps a fold of the conjunctiva at its lower part. The then, with a broad cutting-needle, makes an opening ornea close to its outer margin. The needle should be withdrawn, without rotating it in the slightest degree, the aqueous humour may, as far as possible, be retained. small spatula is to be passed in at the opening, and quickly and steadily across the anterior chamber, so as pose between the lens and the intruding point of the body. The spatula is then to be pressed forward against ign body to keep it fixed, while, with a cataract-knife ng-needle held in the other hand, the surgeon slightly s the wound on the anterior surface of the cornea. Still ng the point of the foreign body with the spatula in the anterior chamber, he endeavours with a very fine and well-closing forceps, to grasp the extremity of the foreign body and draw it out of the wound.

I have had occasion several times to perform this operation, which the minuteness of the foreign body, its close proximity to the transparent lens, and the necessity for limiting the extension of the external wound, combine to render one of the most difficult in ophthalmic surgery.

A foreign body, which passes quite through the cornea, may wound the lens and remain embedded in its substance, producing a traumatic cataract; or it may become fixed in the iris; or, having lost its momentum in traversing the cornea, it may fall down to the bottom of the anterior chamber. Under any of these conditions, if the surgeon sees the case immediately after the accident, while the cornea is still clear, and the iris and anterior chamber are not yet obscured by inflammatory effusions, he should endeavour at once to extract the foreign body. If it can be distinctly seen sticking in the lens, it will be right to make a section of the upper half of the cornea, and remove the lens, as in the ordinary operation for cataract. A chip of metal, fixed in the iris, may be removed with Assalini's spring-forceps,* or the cannula-forceps, introduced through a small corneal wound; and in the same manner foreign bodies of any kind, which are lying loose in the anterior chamber, may be seized and extracted.

The surgeon must not be deterred from attempting to remove these foreign bodies by the stories he will find in many of the older ophthalmic works, about the oxidation, and solution, or encysting of metallic fragments. The lymph which is thrown out around a metallic chip in the iris does indeed, for a time, encase it and hide it from view; but this is only the beginning of a tedious iritis, which will probably end in disorganisation of the eye, or, at least, produce obstruction of the pupil and loss of sight.†

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* This instrument was invented by Assalini for seizing the iris in the operation for artificial pupil; *Ricerche sulle pupille artificiali*, &c. Milano, 1811. For this purpose it has been superseded by the more delicate *cannula-forceps*.

† In a case I communicated to the *Dublin Journal of Medical Science* (n. s. vol. vi. p. 210, 1848), a very minute scale of copper remained fixed in the iris for *eight years*, and, after causing repeated attacks of iritis, was at last thrust forwards against the cornea by the effused lymph; ulceration was set up, and the little fragment, projecting through the cornea, was seized and extracted.

Foreign bodies lying loose in the anterior chamber are to be emoved in a similar way to that I have just recommended in he case of bodies fixed in the iris; the extent of the corneal ncision being of course proportioned to the bulk of the body to be extracted.

This may perhaps be the most convenient place to notice those rare cases in which a living entozoon constitutes the foreign body in the anterior chamber.

The *Cysticercus telæ cellulosæ* has been repeatedly met with in this situation, as a rounded, semi-transparent, vesicular body, furnished with a long retractile neck, terminating in a head furnished with suckers and a circlet of hooks. If not removed, the animal eventually sets up inflammation of the iris and cornea, which ends in total loss of vision. A crescentic incision along the edge of the cornea allows of the escape of the animal along with the aqueous humour. Cases have been reported by many ophthalmic writers, among whom Mackenzie has given the fullest details, and has figured the animal both in its natural condition and magnified.*

All the operations on the cornea just described will be greatly facilitated by the use of the spring speculum, a forceps to fix the globe, and, in irritable and timid patients, by the administration of chloroform.

The *after-treatment* of all the foregoing cases, in which an incision of the cornea may have been necessary for the removal of a penetrating body, mainly consists in keeping the eye perfectly at rest and protected from light, while the healing process is going on. For the first twenty-four hours at least, *both* eyes should be covered with a light bandage. After that period it may be sufficient to keep the wounded eye closed, and the length of time during which this closure should be maintained must depend upon the rapidity with which the wound heals, and the aqueous humour is resecreted—circumstances varying according to the constitution of the patient, and the amount of violence inflicted on the eye by the accident and the subsequent manipulations of the surgeon. Patients should neither be kept low nor over-stimulated, but maintained as near as possible at their natural standard of vigour. Those of an irritable temperament will often require a narcotic for several nights after these operations; but if chloroform has been used a narcotic should not be given while the system is still under the effects of the inhaled vapour.

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* Mackenzie (*Practical Treatise*, &c. 4th edit. 1854) quotes a case of *cysticercus* in the anterior chamber, observed by Schott in 1830; another by Logan in 1833; and relates two cases of his own in 1848 and 1850, and two others in the practice of other surgeons. He also mentions a case reported by Appia, in which the cysticercus is *said* to have been seen within the substance of the cornea. In all these instances the *left* eye was affected, and Mackenzie remarks that 'the left has suffered much oftener than the right eye from the intrusion of *cysticerci*, either under the conjunctiva or into the interior of the organ.' Cases which have been reported subsequently to the publication of Mackenzie's work do not, however, bear out this statement. In the *Archiv für Ophthalmologie*, vol. i. p. 453, is a case of *cysticercus* in the *right* anterior chamber; and in the same journal, vol. iv. p. 113, is another, also in the right eye; Teale has reported a case occurring in the right eye; *Ophthalmic Hospital Reports*, vol. v. p. 320. When Mackenzie wrote, *cysticerci* had never been discovered in the *vitreous* chamber; but in the *Archiv* twenty cases have already been reported, nearly equally divided between the right and left eyes. (See a subsequent note on *cysticerci* on the retina and in the vitreous humour.)

CHAPTER V.

DISEASES OF THE SCLEROTIC.

INFLAMMATION.

(*Rheumatic Ophthalmia* of Mackenzie; *Scleritis*; *Sclerotitis*.)

THE sclerotic is inflamed to a certain extent in all cases of keratitis and iritis, and exhibits that zone of red vessels close around the margin of the cornea which is so marked a symptom of both these diseases. A more extended inflammation of the sclerotic not uncommonly forms one of the complications of catarrhal ophthalmia.

But there is also a form of inflammation which is almost limited to the sclerotic, the conjunctiva being implicated only in a secondary degree, and this sclerotic inflammation may assume either the acute or the chronic form.

In the acute inflammation the whole of the sclerotic is intensely injected, the part assuming a peculiar pink tint, quite different from the more vermilion colour of conjunctival inflammation. In very severe cases the pink tint has a shade of violet, in consequence of the depth at which the vessels lie in the fibrous tissue. Intolerance of light and lacrymation are marked symptoms, and in and around the eyeball there is always considerable pain, which sometimes assumes the form of intense neuralgia throughout the ophthalmic division of the fifth nerve, extending even into the second and third divisions.

The attack is attended with general constitutional derangement; the tongue is coated, the appetite bad, and the urine often deposits large quantities of lithates.

Treatment.—The bowels must be first thoroughly cleared, and then narcotics given, in doses proportioned to the severity of the neuralgia and the former habits of the patient. Half a drachm, or a drachm, of tincture of hyoscyamus may be sufficient in some cases, while in others full doses of morphia will be requisite to insure sleep. In some patients quinine, in others iodide of potassium, is of great service; to those in whom the rheumatic diathesis is more marked, colchicum given in combination with an alkali will be far more beneficial. The patient's appetite is usually so bad that it requires management to induce him to take sufficient nourishment. Beef-tea, bread-and-milk, and various modifications of farinaceous food, are often more readily taken than solid meat. Sugar should be avoided, and beer, as containing sugar; dry wine or diluted spirit being substituted, and of course only given in quantities demanded by the condition and previous habits of the patient. Local depletion by means of leeches seldom produces more than temporary benefit, and blisters only aggravate the neuralgia. Steaming the eyes over hot water is usually soothing, and preferable to fomentation, in consequence of the extreme irritability of the surface of the eye. The most effectual local application is chloroform, diluted with olive-oil according to the susceptibility of the skin, and applied on lint to the temple and forehead. The patient's room should be moderately shaded from light, and the eyes still farther protected, if necessary, by a suitable eye-shade, or tinted spectacles; but complete darkening of the room is unnecessary, and it has the great disadvantage of rendering the examination of the eyes by the surgeon intensely painful during the abrupt transition from darkness to light.

Chronic inflammation of the sclerotic occurs frequently, but by no means exclusively, in rheumatic subjects. Instead of involving the whole extent of the sclerotic at once, it commonly appears as a limited patch of redness, close to the cornea, after a time fading away, and then reappearing on some other portion of the white of the eye, but always keeping close to the corneal margin.

When this chronic inflammation of the sclerotic has gone on for a long time, it has a tendency to involve either the cornea or the iris. In the latter case the iritis is so insidious and so slightly marked as frequently to be overlooked; and it is not until after the sclerotic redness has wholly disappeared that some dimness of vision induces the surgeon to make a careful examination of the pupil; when he will probably detect some small adhesions between the iris and the capsule of the lens, or a filmy opacity of the latter, dotted with minute patches of pigment.

It appears to be this form of obstinate sclerotic inflammation which Wilde* has described as 'inflammation of the ciliary body.' No evidence, however, exists that this structure is specially the seat of inflammation.

Treatment.—Chronic inflammation of the sclerotic is a very tedious affection, and one that is extremely liable to recur, if the patients are exposed to cold and damp, or fall into that dyspeptic condition which induces chronic rheumatism. Strict attention to diet, avoidance of sugar, and substances which form sugar in the system, a dry and temperate climate, will be the best means to prevent the sclerotic inflammation from becoming periodical in its return. Quinine is commonly the most effectual remedy, and blisters to the temples are often valuable adjuncts. But if the patches of redness shift about from one side to the other, fading away at one part, only to reappear at an opposite point of the globe, a vigilant watch should be kept upon the iris, lest it should be attacked with inflammation. If the pupil becomes sluggish and slightly irregular, a careful examination with concentrated light will probably reveal a very slight, barely perceptible, deposit of lymph fringing the pupillary margin. The sight will at the same time be more or less cloudy. In such a case mercury must be carefully given to check the iritis. Two grains of calomel with half a grain of opium may be given at bedtime; or, if the iritis be more acute, and the deposit of fibrin more considerable, the calomel and opium may be given for a few days, night and morning; and as soon as the deposit begins to be absorbed, the dose may be restricted to two grains a day, or even that quantity may be cuts of the sclerotic, inflicted with sharp bodies of kinds, frequently involve the subjacent structures, the and retina. If the latter be extensively divided, a or less quantity of the vitreous humour is almost sure st. The laxity of the conjunctiva, however, often serves t the escape, as the tenacious fluid becomes entangled the meshes of the sub-conjunctival areolar tissue.

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* *Medical Times and Gazette*, n. s. vol. ix. p. 515, 1854.

prognosis of wounds of the sclerotic depends upon their the amount of vitreous humour which has been lost, and, ll, upon the fact whether or not the foreign body inthe wound has penetrated into the interior of the globe. und made by the entrance of a grain of shot is usually nall, as the elasticity of the sclerotic causes its fibres, eing separated by the shot, instantly to close up again, as it had passed through them. When quite recent, wound in the sclerotic is hidden by a little patch of xtravasated beneath the conjunctiva. The entrance of a f shot, or a fragment of metal, through the sclerotic into eous chamber is almost certain to set up a slow inflamof the whole globe, ending in loss of sight and atrophy of an.

le punctures and small cuts through the sclerotic, unatwith the retention of any foreign body, commonly unite

Rupture of the sclerotic with displacement of the lens.—A very remarkable injury sometimes happens to the sclerotic, consisting in a laceration extending completely through its substance, within a line or two of the corneal margin, while the conjunctiva remains unbroken, and the dislocated lens, slipping out through the rent in the sclerotic, becomes firmly wedged beneath the conjunctiva.

This rupture of the sclerotic always takes place on the side of the eye opposite to that which has received a severe blow with some blunt body; the fibres, being suddenly put on the stretch, give way at the point where they are the most bent. Hence it is that the seat of rupture is almost always either the upper or the inner part of the globe, the lower and the outer portions being comparatively exposed to violence, while the prominence of the eyebrow above, and of the nose internally, defends the upper and the inner portions.

Rupture of the sclerotic, with sub-conjunctival dislocation of the lens, is always attended with some injury to the iris. Either that portion adjacent to the sclerotic wound is drawn into it, the pupil remaining large, and displaced towards the margin of the cornea, or else the shock causes the ciliary attachment of the iris to give way to a greater or less extent.

It sometimes even happens that the whole ciliary attachment gives way, and the entire iris is driven completely out of the globe, through the rent in the sclerotic, along with the aqueous humour, lens, and a portion of the vitreous body. This large escape of the contents of the globe only takes place, I believe, when the conjunctiva is also ruptured.*

When a recent case of ruptured globe is seen soon after the infliction of the injury, the parts are so obscured by blood that it is often impossible to form a correct estimate of the damage the globe has sustained. Detachment of the iris from its ciliary connection is always attended with bleeding, which may completely hide everything behind the cornea. The lens, too, if dislocated beneath the conjunctiva, is often enveloped in blood, so that its form cannot be precisely defined. Until the blood behind the cornea has been absorbed, it is impossible to ascertain whether the retina has retained its function; so that in every case the prognosis will be extremely doubtful.

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* See two cases in which the lens and iris were driven out of the eye through the ruptured sclerotic, published in my *Practical Guide*, &c., 2nd edit., pp. 398–9. Also a case of sub-conjunctival dislocation of both lenses in the same person, p. 113, *note*.

Treatment.—If the detached iris is hanging out of the wound through a rent in the conjunctiva, it should be snipped off with scissors; but inasmuch as the lens, if lying between the unbroken conjunctiva and the sclerotic, may be so obscured by effused blood as to be with difficulty recognised, it will be well to wait a few days until the blood has become absorbed, and then the division of the conjunctiva covering the displaced lens will allow of its easy removal.

Absolute rest of the eye is the one important point in the treatment of all cases of ruptured globe. For the first few days, both eyes should be kept closed, by means of strips of plaster or a light bandage. Afterwards, it will suffice to close the injured eye only; but this closure should be uninterruptedly maintained for a week or ten days.

The patient should not be kept on low diet, nor depleted in any way; least of all should he be brought under the action of mercury, as is too often done. Such treatment can only have the effect of lowering his reparative power, and so retarding the process of cure.

CHAPTER VI.

DISEASES OF THE IRIS.

CONGENITAL DEFECTS.

(*Irideremia; Coloboma; Misplaced pupil; Persistence of membrana pupillaris.*)

CONGENITAL absence of iris (*irideremia*) always attracts the notice of those about the infant by the peculiar reddish glow which is reflected from the retina. The child seems to shrink from strong light, and there is a good deal of unsteadiness of the globes. The whole space behind the cornea presents one uniform red or orange tint, while the edge of the lens is marked out by a ring of golden light.

Although the term *irideremia* would imply a total absence of iris, a slight rudiment of it is often found, forming a very narrow segment of a circle skirting some portion of the edge of the cornea.

Considering that a certain number of infants affected with this rare malformation are yearly brought for an opinion to our public eye-hospitals, it is singular that an adult thus affected is so seldom met with. I can only remember to have seen one such case, a short notice of which I published a few years ago.[*]

Coloboma.—This congenital malformation is the result of an arrest of development, whereby the coalescence of the two halves of the iris is prevented; the pupil, therefore, presents an elongated form, and extends down to the lower edge of the cornea.

A median fissure of the lower portion of the choroid accompanies *Coloboma iridis*. The iris and choroid being formed in the embryo from one vascular membrane curved upon itself, an arrest of development causes in both structures the same kind of defect along the median plane of the eyeball.

Coloboma iridis, however, is not always placed exactly on the median plane of the eye, but sometimes a little to the inner or outer side of it. It usually co-exists in both eyes, although not always in the same degree. Sometimes, instead of the pupil being prolonged down to the bottom of the cornea, an abortive attempt, as it were, to form a coloboma is evidenced by a puckered groove in the iris, extending downwards from the lower edge of the pupil. The actual size of the pupillary aperture in coloboma is not always quite so great as, on a superficial inspection, it appears to be; for the extreme edge of the aperture, when minutely examined, will sometimes be found to be fringed with a blackish-brown pigment; and this at first sight produces the effect of a larger area than really exists.

An old prolapse of the iris through an ulcer, situated at the lower edge of the cornea, by drawing the pupil directly downwards, may produce an appearance a good deal like a *coloboma* iridis. The white cicatrix, however, in the former case, would always enable the careful surgeon to recognise the true character of the deformity.

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[*] *Guide to the Practical Study*, &c. 2nd edit. p. 400. Samuelson describes a case of *irideremia* in a man of forty-eight. Not only were the irides absent, but the closest scrutiny failed to detect any ciliary processes. His accommodation seems not to have been tested; but he asserted it to be perfect; *British Med.-Journal*, 1863, p. 495. In the *Monatsbl. für Augenheilk.* 1866, *irideremia* is noticed as existing in a woman of forty-two. Her eldest child had the same defect. Hulme reports a case in a man aged twenty-two. He could read No. 6 of Jæger's test-types; *Med.-Chir. Trans.* vol. xliv. France gives another case, a woman aged twenty-three; *Guy's Hospital Reports*, vol. vii.

Another abnormal condition of the pupils consists in their being placed near the margin of the cornea, instead of opposite o its centre. Mal-position of the lens appears frequently to ccompany this eccentric position of the pupils.*

Persistence of the fœtal *membrana pupillaris* has been decribed as sometimes causing an obstruction in the pupil which ight be mistaken for congenital cataract; but no practised bserver could make such a mistake; for the *membrana pupillaris* attached, not to the margin of the pupil, but to the anterior ce of the iris, at a little distance beyond, where there is a more r less elevated ring of small tufts or nodules. Projecting from his part of the iris, I have occasionally seen slight vestiges of he pupillary membrane, in the form of little spurs or tags.

The persistence of any portion of this membrane, even in oung persons, is a circumstance of extreme rarity. Dr. Cohn, n the *Klinische Monatsblätter für Augenheilkunde*, 1867 (p. 62), nters into an analysis of the cases published by different authors, nd dismisses all of them except five as originating in a faulty iagnosis. He describes four cases from his own observation. I think there can be no doubt that, in most of the instances reported, old adhesions, the result of bygone iritis, have been mistaken for shreds of the membrana pupillaris.

The following case appears to be worthy of record, as exhibiting a vestige of the pupillary membrane in a person of middle life.

In the summer of 1867, a lady, aged thirty, consulted me for short-sightedness. The case was a very simple one, the myopia not in any high degree, and suitable glasses were all she required. I noticed a fine hair-like thread running obliquely across the pupil of the right eye, and at once recognised it as a vestige of pupillary membrane. It gave the patient no inconvenience, and indeed she could not be made aware of its existence under any illumination I could apply. Fig. *a* represents the eye with the pupil in its natural state, and Fig. *b* after atropine. I had expected to find that, as the pupil dilated, while the two sides of the iris were held together by the little thread, the aperture would become irregular; but this was not the case to any appreciable extent. The iris, of a thoroughly healthy appearance, was of a rust-brown, and the filament was only a little paler in colour. At each end it had a bifid attachment, and looked like a portion of the proper fibrous tissue of the iris drawn confuse the practitioner. The extent to which this evil has spread can be fully appreciated by those only who are familiar with German medical literature.*

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* Figures of unusually extensive coloboma iridis, and of congenital malposition of the pupils, illustrate a paper of mine in the *Ophthalmic Hospital Reports* for 1858 (plate iv. figs. 2 and 3).

This passion for subtle refinements and nomenclature has been comparatively rare with English writers; and those whose practical experience has been the most extensive have made use of the simplest classification.

Lawrence divides iritis into *acute* and *chronic*, and limits its constitutional modifications to four, the *syphilitic*, the *gouty*, the *rheumatic*, and the *scrofulous*. Tyrrell adopts the same arrangement.

There are certain signs common to all cases of iritis, under whatever constitutional modifications it may be developed; such are, a well-marked sclerotic zone; diminished mobility of the pupil, with more or less change in its form; a loss of the peculiar fibrous appearance of the iris; and a change in its colour.

Other signs mark the peculiar constitutional influence which has given rise to inflammatory action in the part. These will be noticed under the proper heads.

TRAUMATIC IRITIS.

Incised wounds of the iris are not the injuries which cause the greatest amount of inflammation in its tissue. On the contrary, clean cuts, even if very extensive, produce but little inflammatory reaction; while bruising, or continued pressure of the part, such as occurs in certain displacements of the lens, invariably gives rise to inflammation and adhesive deposits.

The wounds which are sometimes accidentally inflicted on the iris during the operation for extracting a cataract, or those which are intentionally made, to form an artificial pupil, are rarely followed by iritis; and when, after a few days, the eye is examined, more or less blood may be found at the bottom of the anterior chamber, but the fibrous tissue of the iris will present almost its ordinary aspect.

The lodgment of a foreign body, however, even of the smallest size, always sets up iritis, which does not permanently cease until the foreign body has been removed. As foreign bodies,

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* For remarkable instances of this mania for subdivisions and uncouth names, see the work of Von Ammon, *De Iritide*, 1836; and that of Rau, *Die Krankheiten und Bildungsfehler der Regenbogenhaut*. 1844.

efore reaching the iris, must have passed through the cornea,
have thought it best to treat of them in Chapter IV., under
he section 'Injuries of the Cornea.'

A singular accident which sometimes befals the iris may be
entioned in this place, although it is really attended with very
ttle iritis, namely, detachment of the iris from the ciliary liga-
ent. The organic connection beween these two structures is
slight that a smart blow with a stick or a whip, the rebound
a twig, or the shock of a spent shot, is sufficient to sever them
om each other; the extent of the separation varying in every
ssible degree, from a mere hair's-breadth to the complete
tachment of the whole iris from its ciliary connection.

A very slight separation may almost escape notice. It
pears as a small, black, elongated mark, close to the extreme
ge of the cornea. In proportion to the extent of the separa-
n will be the amount of deformity of the pupil; and when
lf of the circumference of the iris has been detached, the pupil
ll probably fall together and be wholly effaced.*

In all extensive cases of detachment, there is bleeding into
e anterior chamber; sometimes to such an amount as at first
conceal the injury from view.

Unfortunately the surgeon can do very little in these cases.
replace the detached iris is utterly impossible, and vision
ust inevitably remain greatly impaired; but at least he can
stain from attempting to hasten the absorption of the effused
ood by administering mercury. It may seem unnecessary to
ution any one against such practice, but, in fact, the dogma
at 'mercury induces absorption,' is so firmly fixed in some
inds, that instances are constantly occurring of patients being
tually salivated as a means of promoting the absorption of
ood which is filling the anterior chamber after rupture of the
s. The rational mode of treatment is to defend the eye
om strong light, and to keep the general vigour of the patient
to a healthy point, and then nature will in due time com-
etely absorb the blood, without any aid from drugs.

I have observed how readily the iris inflames when subjected
long-continued pressure. The most striking examples of this

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* The appearances presented by separation of the iris from its ciliary attach-
nt may be seen in most of the illustrated ophthalmic works. I may instance
ckenzie's *Treatise*, 4th edit. p. 396; Cooper, *On Wounds and Injuries of the*
e, 1859, pp. 170, 173, 175; Lawson, *Injuries of the Eye, Orbit, and*
elids; 1867.

are seen, when, in consequence of a blow upon the eye, the lens has been loosened from its connections, and partially dislocated into the pupil. The traumatic iritis is still more severe, if there be, at the same time, an incised wound of the cornea. In that case, the aqueous humour drains away, and, in consequence, the iris becomes compressed between the cornea and the displaced lens.

Inflammation of the iris soon sets in; vessels become visible in its tissue, and lymph is effused into the pupil, into which the lens is bulging. The cornea becomes hazy, and is traversed by vessels. The sclerotic and conjunctiva are deeply injected, and there is abundant secretion of tears. If the case be left to itself, or injudiciously treated, the pupil becomes eventually closed with effused lymph; or else the cornea softens and gives way. Meantime the deep tissues become disorganised, and, after protracted suffering, the patient finds the eye utterly useless.

The only way to anticipate all this mischief is to remove the displaced lens, which is acting like a foreign body. To do this requires much tact and care, and, in making the requisite opening in the cornea, the surgeon must endeavour to avoid isolating any considerable portion of corneal substance between his incision and the wound already existing in the cornea, lest the isolated portion should slough from interrupted nutritive supply. Sometimes the wound in the cornea is so placed that the surgeon, by enlarging it, can make an opening sufficient for his purpose. But if the wound be in the centre of the cornea, it is usually desirable to make the incision in a new portion, and as near the margin as possible. If the substance of the lens has been much broken by the original injury, the greater part of it will probably escape when pressure is applied; but if the lens be almost entire, it must be broken up as much as possible before any attempt at pressure is made. The use of the scoop will greatly facilitate the removal of the disintegrated lens, the pulpy substance escaping along the groove. In some cases the removal of a portion of iris will not only facilitate the removal of the lens with the scoop, but will prevent the occurrence or continuance of iritis.

The success of such an operation will depend upon its being performed soon after the accident, while the cornea is still clear, and before iritis and effusion of lymph have set in. If performed at a later period, there will be greater risk of vitreous humour

g lost. In all cases the success of the operation, as regards
ration of sight, must be very doubtful; and if performed
late period, relief of pain, and prevention of complete dis-
nisation of the globe, will probably be the best result that
be hoped for.

ie treatment, after such an operation as I have just noticed,
be similar to that after an ordinary case of extraction of a
act. Closure of both eyes for four or five days will be
ssary, and the reparative powers of the patient must not be
ssed by privation of due nourishment.

e surgeon must not deceive himself with the belief that in
cases of wound of cornea, with displaced lens, the ad-
tration of mercury can avert destructive inflammation.
fficacy of mercury in controlling the effusion of lymph in
raumatic iritis, arises from the fact of there being, in
case, no foreign body—which a displaced lens really is—
ing against and irritating the iris. *Traumatic iritis,* set
a displaced lens, is wholly beyond the powers of mercury,
its administration can only do harm, by lowering the
nt's reparative power, and so unfitting him to recover from
peration, should removal of the lens be ultimately re-
l to.

Rheumatic Iritis.

eumatic inflammation of the iris assumes either an *acute* or
nic character. In the former case, the attack can usually
ced to exposure to cold wind or damp, when the body has
exhausted by fatigue or greatly overheated.

cording to the nervous susceptibility of the patient, the
of an attack of rheumatic iritis will be attended either by
pain in and around the eyeball, or by acute neuralgia
ghout the first division of the fifth nerve, extending even
second and third divisions.

ien the attack is severe, there is usually a good deal of
rance of light, and lacrymation. The vascular zone is not
narked, on account of its being lost in the general injection
e whole sclerotic, which assumes the purplish tint I have
bed as characterising sclerotic inflammation.

eumatic iritis is almost always attended with some slight
ess of the cornea, and in this respect it differs remarkably
the syphilitic form, which, even in the most severe cases,

often leaves the cornea perfectly clear. The morbid changes in the iris itself are sometimes so slightly marked as to escape an unpractised or a careless observer; so that it is not until the inflammation has subsided, and the cornea has become quite clear, that the still-existing impairment of sight causes a more careful scrutiny of the pupil to be made, and then inflammatory exudation into its area, and adhesion of its margin, are found to have taken place.

In the more acute form of rheumatic inflammation, the veins of the iris may be traced on various parts of its surface, as delicate red lines, diverging from the edge of the pupil to the periphery of the iris. I need hardly say that these fine vessels cannot be traced if there exists any considerable haziness of the cornea.

The pupil is contracted, more or less irregular, and as the inflammation goes on, this irregularity becomes more marked, in consequence of effusion of lymph* taking place between the edge of the pupil and the capsule of the lens. The insidious manner in which this fibrinous effusion occurs affords a marked contrast to the rapidity with which large masses of yellow or reddish-yellow lymph show themselves on the edge of the pupil in syphilitic iritis.

I have already noticed the neuralgia throughout the region supplied by the ophthalmic division of the fifth nerve, which attends an acute attack of rheumatic iritis. There is also very frequently considerable febrile disturbance, the urine being loaded with lithates.

The majority of cases do not present such acute symptoms as those just described, but pursue a more chronic course. The injection of the sclerotic being less general, the vascular zone around the cornea is better marked; there is little, if any, intolerance of light or lacrymation, and instead of severe neuralgia in the fifth nerve, there is only a dull aching pain in and around the eyeball.

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* In describing iritis, I shall frequently have occasion to speak of that exudation from its vessels which constitutes the most serious feature of the disease, by forming adhesions between the pupillary margin and the capsule of the lens, or wholly blocking up the area of the pupil with opaque membrane. Whether this *exudatum* becomes itself converted into fibrous tissue, or whether it only influences the cells of the tissue among which it is effused, and causes new cells to be developed from those already existing, is a physiological question which can hardly be decided. I have used the term 'lymph' to describe this *exudatum*, because the word is familiar to all my readers, and is sanctioned by long usage.

But, whether the iritis be acute or chronic, there is still the same danger of effusion of lymph into the area of the pupil, and this danger is, as I have said, all the greater on account of the gradual and insidious manner in which the effusion takes place. To check this is the main object to be kept in view.

Treatment.—If the early stage of acute rheumatic iritis be attended with severe neuralgia, as is frequently the case, the treatment will be much the same as that which I have described in Chapter V., as suitable to acute inflammation of the sclerotic. In some patients iodide of potassium, in others colchicum, will be of most service; while some cases, characterised by visible enlargement of the veins of the iris, yield to turpentine. I have usually given the Chian turpentine in substance, as pills, four grains three times a day. The condition of the pupil must be carefully scrutinised from day to day; and if it be found irregular and angular, or if any brownish tags appear to be forming at its edge, mercury must at once be given. Two grains of calomel, with a third or half a grain of opium, may be taken night and morning; and should any tenderness of the gums begin, the quantity ought at once to be diminished; for if salivation be allowed to occur, the neuralgia is almost certain to return, and the mercury, which in small doses was so beneficial, begins at once to exert its depressing influence. In delicate subjects it is often very useful to give a dose of bark—Battley's liquor cinchonæ or quinine—in the middle of the day, during the time the mercury is being taken. During the inflammatory stage the pupil is to be kept under the action of atropine.

It is almost impossible to lay down precise rules about diet. It should not be *low*—that is to say, innutritious—but light and easily digestible: soup, bread-and-milk, farinaceous food of various kinds, with or without a proportion of meat, according to the patient's digestive powers and previous habits. Stimulants should be given only in such quantities as may be necessary to sustain the circulating forces. Feeble and depressible persons may require a certain amount of dry wine, or diluted spirit, while those addicted to habitual indulgence may only eliminate the rheumatic poison which they have stored up in their blood, by abstinence from the alcohol and sugar they have so long abused.

Occasional steaming of the eye over hot water is the most soothing local application, and where neuralgia is present, is preferable to fomentation by means of wetted compresses.

Leeches to the temples may occasionally be found useful at the onset of an acute attack; but where neuralgia exists they commonly do harm, and they should never be applied to feeble and depressible subjects, or those liable to erysipelas. Blisters also have the disadvantage of exasperating neuralgia. They are, however, very serviceable in the chronic form which often succeeds the acute attack, and they certainly aid in removing that haziness of the cornea, which, if not promptly dispersed, is apt to become permanent.

SYPHILITIC IRITIS.

Inflammation of the iris originating in syphilis is very frequently associated with other forms of secondary or tertiary disease, especially with eruptions on the skin. It is by far the most marked kind of iritis, and is characterised by a tendency to rapid and abundant inflammatory exudation on the iris, especially about the edge of the pupil, in which situation yellow, reddish-yellow, or nearly red nodules sometimes attain to such a size as almost to close up the pupillary area.*

The cornea is either clear, or marked throughout its lower half by very minute dots, of a pale buff tint. These dots are as small as if pricked in with the point of a pin, and are so closely set together as to suggest to a superficial observer the idea of a faint cloudy haze. It often happens, however, that even these minute dots are wholly absent, and the cornea, during an acute attack of iritis, remains perfectly transparent.

There is always a vascular zone in the sclerotic, but not that generally diffused redness of the eyeball so frequently present in rheumatic iritis. Neither, as a rule, is there intolerance of light, which is one of the most marked symptoms of the rheumatic form.

Irides which have naturally a bluish tint, when attacked with syphilitic inflammation, appear more or less green. This is caused by the presence of yellow albumen in the aqueous humour, the admixture of the yellow and blue forming, of course, a green tint. This fact may be demonstrated in some of those old cases in which chronic iritis has attacked an eye again and again, until sight has been lost, nearly all the tissues having undergone a morbid change. If in such a case the cornea be carefully punctured with a broad needle, and the fluid of the anterior chamber caught in a spoon, the application of heat will at once show the presence of albumen; and if the iris have been originally bluish, that colour will be restored as soon as the last drop of the yellow fluid has drained away from the anterior chamber.

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* In Sichel's *Iconographie* (pl. xiii fig. 5), is a good representation of a mass of lymph, reddened with vessels, at the edge of the pupil.

When a patient has syphilitic iritis for the first time, it may attack both eyes together, or may be limited to one eye. When relapses occur, the inflammation usually affects the right and left eye alternately; and these attacks may come on without the patient having contracted any fresh primary disease.

Syphilitic iritis is so much modified by the condition of the patient, that the surgeon must take care not to form to himself any arbitrary idea of the appearances, or expect to find in every case the strongly-marked and unmistakable proofs afforded by large nodules of exudation around the pupil. In fact, iritis may exist to such an extent as to produce serious and permanent obstruction to the pupil, without any development of these nodules. In some cases the lymph is uniformly distributed around the margin of the pupil, which then assumes a thickened ring-like appearance, the rest of the iris exhibiting little, if any, deviation from its healthy aspect. The loss of its mobility, however, is always well marked, even in the slighter cases; and, indeed, the sluggishness or total immobility of the pupil, when exposed to light, is one of the most valuable diagnostic signs of iritis in its early stage.*

Occasionally the nodules of lymph, instead of appearing on the edge of the pupil, are situated on the greater circle of the iris, in the re-entering angle formed between it and the cornea. Such cases are comparatively rare.

In every case of iritis, the surgeon should most carefully examine the area of the pupil, to determine whether it be or be not overspread with lymph. This sometimes exists merely as a very thin film, which may escape detection, unless light be concentrated upon it by means of a lens of short focus. Such a film, however, if not speedily removed by proper treatment, will rapidly become thickened by fresh deposits, and, growing more and more opaque week by week, will eventually form a serious obstacle to the transmission of light.

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* I cannot point out any really good representation of iritis in its early stage. Indeed, it is hardly possible for an artist to convey a true notion of the delicate changes in form and colour which characterise the disease at that period.

The so-called 'closure of the pupil,' justly regarded as the most serious termination of unchecked iritis, is caused partly by the nodules of lymph which are thrown out upon the margin of the pupil, and unite it to the capsule of the lens (*synechia posterior*), and partly by fluid exudation of the same inflammatory kind, which overspreads that portion of the capsule corresponding to the pupillary area. This exuded fluid, as it solidifies, forms organised connections with the nodular deposits on the edge of the pupil, and eventually, by its contraction, draws the margin of the pupil together, and permanently blocks up its greatly diminished space with a tough, firm, and opaque membrane.*

Treatment.—From what has been said, it will be seen that the leading principle in the treatment of syphilitic iritis consists in procuring as quickly as possible the absorption of the lymph which has been effused in and around the pupil. To effect this, the most powerful agent is *mercury*. But when we consider the variety of constitution in patients attacked with syphilitic iritis, the impaired state of general health they frequently exhibit, in consequence of venereal taint, and the period at which the iritis sometimes occurs—namely, while they are only just recovering from the debilitating effects of salivation—it is evident that, in a treatise like the present, little more can be done than to indicate the outlines of treatment, and that the judgment and tact of the surgeon must be brought to the careful study of each individual case.

When a recent case of syphilitic iritis comes before us in a patient of good general power, we may at once order two grains of calomel, with a third or half a grain of opium, to be taken night and morning; first clearing the bowels, if necessary, by a rapidly-acting aperient. In private practice, where our patients are not necessarily exposed to the weather, the calomel may be given more frequently, but in smaller doses; a grain, for instance, every four hours, combined with just enough opium to prevent purging.

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* This form of obstruction is sometimes called 'spurious cataract;' but the term is manifestly improper, as the word 'cataract' should be strictly limited to opacity of the lens itself.

he effect of the mercury must be judged of by the state of eye, not by the soreness of the gums. Indeed, I look upon ness of the mouth as a condition to be always avoided, if sible; never to be willingly produced, as is so often the case. soon, therefore, as the gums begin to be at all affected, the mel is to be given less frequently; the absorption of the ph in the pupil being the test of the mercury having been ctual. The two-grain pills may be taken once instead of ce a day; the grain every four hours changed to the same ntity every twelve hours, and then taken at twice that in- ral of time.

patient sometimes comes before us with recent iritis, which come on while he was actually under the influence of mer- y, given for venereal disease. What are we to do in such a e? Perhaps we shall find that the patient, while taking the rcury, has been kept on very low diet, deprived of all animal d, and restricted to 'slops.' In that case, the mere change a better diet—animal food and other nutriment being given, h a moderate quantity of the stimulant to which he has been ustomed—will often effect a surprising change, and stop further effusion of lymph; while iodide of potassium, with k, or, if the patient be extremely depressed by the mercury, n quinine alone, will at once cause absorption of the lymph begin.

r a directly opposite state of things may exist. The patient y have sought relief from the depressing effects of too much rcury by indulging in stimulants, and in this way may have uced an irritable condition of the circulation, quite incompa- e with a due interchange of material in the system. Restric- of stimulants within due bounds will be as essential in this e as their use had been in the case of the ill-nourished and emic patient.

f a patient has been attacked with syphilitic iritis while under depressing influence of too much mercury, given for general hilis, and it has been found necessary to suspend the use of mercury until tonics and a change of diet should have im- ved his general health, we shall often find, that by resuming mercury in *small* doses, while at the same time we continue tonics, the iritis will yield, although it may have resisted the e doses which had been given under circumstances of over- ulation or deficient nutrition.

urpentine was recommended by Carmichael, as a substitute for mercury, in those cases to which I have alluded as unsuitable for the administration of the latter, on account of general debility. I have, however, found more benefit from the use of iodide of potassium, or even of very small doses of mercury, combined with tonics and improved diet, as above described. I have sometimes found turpentine of service in cases of rheumatic iritis, characterised by hyperæmia of the iris and sclerotic, but unattended with much disposition to effusion of lymph.

Whether the iritis be treated with mercury or not, the pupil is to be kept dilated by means of atropine.

Syphilitic iritis has often a tendency to become *chronic*; each relapse being characterised by a slight sclerotic zone, a yellowness of the aqueous fluid, giving a greenish tint to blue irides, general dimness of sight, and a slight filmy deposit in the area of the pupil. This chronic form is chiefly found in patients who are the subjects of tertiary syphilis, and a carefully-regulated course of iron often affords the best means of treatment.

In describing iritis, I have hitherto spoken only of those changes which are visible under ordinary observation; but the ophthalmoscope has demonstrated to us, what we formerly could only guess at, namely, that in so-called iritis the *retina* is often more seriously affected than even the iris itself.

To attempt to examine the retina during an acute attack of iritis, would be not only useless, but injurious; for the lymph deposited in the pupil, and perhaps in the vitreous humour also, would prevent any clear view of the parts behind; while the glare of light would be almost certain to increase the already existing hyperæmia of the organ. We often, however, have the opportunity of examining the retina after all inflammation has passed away, leaving the cornea, lens, and vitreous humour transparent. We can then fully appreciate the close connection between syphilitic inflammation of the iris and of the retina, and understand why it is, that in cases of so-called 'iritis,' the dimness of vision is often out of all proportion to the changes in and about the iris.

One of the sequelæ of iritis (I use the word 'iritis' in its more extended sense), is a cloudy condition of the vitreous humour, in which filaments and shreds, varying in shape and size, float freely in every direction. These bodies, although really whitish, of course appear black, or nearly so, when seen against ɔm the nerve are small and shrunken. Large, irre- patches are scattered over the retina, in some cases e greater part of its surface. These appear to be the nervous coat infiltrated with lymph, and no eated by vessels. Patches and dots of black pig- quently seen scattered over and among these opaque he retina. (Plate II. fig. 1.)

appears that syphilitic inflammation, when it attacks exhibit its chief phenomena in the iris, involving nly to a very slight extent; or both structures may ffected; or lastly, the retina may suffer in such a most to become useless, while the iris shows little, of inflammation, and the patient is hardly aware eing the subject of disease, until vision is found to st.

SYPHILITIC IRITIS IN INFANTS.

ne of the rarest forms in which hereditary syphilis elf during infancy. The careful researches of Mr. ,* however, have shown that it is not quite so rare supposed; and it probably often escapes notice on he observes, of the very small amount of local symp- it causes, coupled with the fact that infants usually yes shut. Within the last ten years I have seen but

One of the most striking peculiarities of iritis in infants is the very slight development of a sclerotic zone, that unfailing sign of iritis in the adult. Indeed, in some of the cases I have seen sclerotic redness could hardly be said to exist.

The infant at the age of from two to ten months is attacked with copper-coloured eruption; perhaps also with mucous tubercles about the genitals, aphthæ in the mouth, and 'snuffles.' The eyelashes fall off, and sometimes the nails also are partially detached. In some cases the skin presents a peculiar dusky tint, and is wrinkled and scurfy.

The lymph does not assume the form of solid tubercular masses on the edge of the pupil, as in the adult, but either fills the area of the pupil, as a pale yellow semi-fluid mass, or sinks down to the bottom of the anterior chamber, like ordinary *hypopyon.* In one of the cases I saw, the lower half of the iris was completely hidden by a nodular mass of lymph, of a pale buff tint, which came into contact with the cornea, and completely filled the anterior chamber as high up as the middle of the pupil.* In another case, the effused lymph—for such it seemed to be—was scattered all over the lower half of the iris in the form of little, greyish-white, semi-transparent granules, like grains of coarse sand. The pupil was fringed with the same kind of deposit.

Treatment.—Before speaking of any special medicines for infants affected with syphilitic iritis, I would remark on the absolute necessity for their being suckled, and not brought up by hand. The milk of a healthy wet-nurse would of course be infinitely preferable to that of an infected mother; but in the lower classes of society, among whom this disease is almost exclusively met with, the services of a wet-nurse can hardly be obtained.

Mercury should at once be given; and as hydr. c. cretâ is very uncertain in its chemical composition, I always make use of calomel, giving from a quarter of a grain to half a grain night and morning. The effect of the medicine must be carefully watched from day to day, and as soon as the lymph begins to disappear from the eye, and the cutaneous eruption to fade, the dose may be gradually diminished; but it will often be necessary for the mercurial to be continued, in a modified form, for several weeks. nfants will be much benefited by taking five minims of liquor cinchonæ twice a-day in a little milk. Provided sucks and digests well, the mercury does unmixed , by counteracting the venereal poison, not only frees rom the specific eruption, but imparts to it a healthy ad of the peculiar dusky colour which was originally t.

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* *Guide to the Practical Study of Diseases of the Eye*, 2nd edit. 1859, p. 149, fig. *a*.

drops of a solution of atropine containing two grains of ate to an ounce of water, may be put into the eye once powerful a poison cannot safely be used without limit infants, even in its diluted form.

Scrofulous Iritis.

f the patients in whom I have observed this form of e been between five and fifteen years of age, and all n signs of a scrofulous constitution.

tis presented a resemblance to the syphilitic inflamma- ults, in respect of the abundant exudation which took the iris, and in the anterior chamber; but in the severer he scrofulous form there was a still greater disposition ement of the veins of the iris, and infiltration of its ue, than is usually met with in syphilitic cases. In iritis the large masses of yellow deposit are not so fre- mited to the margin of the pupil, but often appear etween the pupil and the outer circle of the iris, or at point, just in the angle between the iris and the Slight bleeding not unfrequently takes place into the hamber, from giving way of the distended veins of the

rnea usually remains clear, but it sometimes presents egree of mottled opacity, especially towards the lower

ent.—In the treatment of scrofulous iritis, as in all s affections, the diet and general mode of life deserve st attention. Abundance—not excess—of animal food; thing; pure air—sea-air, if attainable—are all im- djuncts to the medical treatment. Cod-liver oil is reat service, and may be taken in combination with remedies. The bowels are usually irregular, and the appetite bad; and a mild aperient will be occasionally required; but care should be taken to avoid drastic purgatives, such as scammony and jalap.

When there is abundant inflammatory exudation into the anterior chamber, without much enlargement of the veins of the iris, or development of a sclerotic zone, half a grain or a grain of calomel at night, and two or three grains of quinine, or ten or twelve minims of liquor cinchonæ, taken an hour or so after a meal, will often produce a rapid absorption of the effused fluid. Where the exudation assumes the solid form, infiltrating a considerable portion of the iris, or appearing at its inner or outer circle as large yellow nodules, reddened with vessels, the iodide of iron is often useful, both in promoting the absorption of the deposit, and in diminishing the vascularity of the iris itself.

All stimulating lotions must be avoided; nor, indeed, except atropine, is any local application of service.

GONORRHŒAL AND ARTHRITIC IRITIS.

I have never been able to trace an attack of iritis as a result of simple gonorrhœa; although, of course, it may often happen that a patient is attacked with ordinary rheumatic iritis within a short period of his having had urethral discharge. Gonorrhœa is unfortunately so common, that were there any definite form of iritis dependent upon it, so marked a sequela of the discharge would be constantly brought under our notice.

Neither have I seen cases of iritis which I could refer to gout. The descriptions of 'arthritic iritis' one meets with in books are chiefly taken from German writers, especially Beer and his contemporaries, whose account of the disease, which they term *gouty* inflammation, more nearly answers to that of chronic glaucoma. The ash-coloured ring in the sclerotic, immediately surrounding the cornea, described by German writers as the *arthritic* ring or circle, and regarded by them as diagnostic of arthritic iritis, is not peculiar to any special form of inflammation. Its presence merely depends upon the anatomical arrangement of the adjacent portions of the sclerotic and cornea. When these two structures are united obliquely, so that a considerable extent of the sclerotic is overlapped by the cornea, the vessels of the former do not appear to advance so near to the iris as in other cases; and hence a narrow ring, of a paler tint, is

Of course the action of atropine will be most evident : cases where the inflammation is quite recent, and where ently the tissue of the iris is not, as yet, much thick- congestion of its vessels, nor infiltrated with lymph. abundant effusion of the latter has taken place around rgin, and within the area of the pupil, atropine may duce any change visible to the observer; but when this f effusion has not yet arrived, or when, at a later period, ssing off, persistent dilatation of the pupil may be in- by atropine, and such dilatation will have the effect of ng the formation of adhesions between the iris and the , or of causing such adhesions, if already existing, to ay. In all cases of iritis, therefore, a solution of e should be dropped upon the eye night and morning. the inflammation is recent, and atropine is used in ation of lymphatic effusion, rather than to counteract idification of deposits already formed, a solution of two of the sulphate of atropia in an ounce of distilled water, employed; but in the more acute cases a solution of that strength will be required.

contented with insisting on the utility of atropine as an t to mercury in the treatment of iritis, some recent have even gone so far as to recommend that the disease be treated by the use of atropine alone. More danger- ifling I cannot conceive. No doubt cases of iritis occur ch the tendency to effusion of lymph can hardly be said t at all, and such exceptional cases may possibly get well mercury? Used ignorantly, as we too often see it used, mercury is a fearful curse to mankind; but moderately and judiciously used it is one of our greatest blessings. If patients with iritis are to be so impregnated with mercury that profuse salivation and all the other miseries of mercurial poisoning are induced, they may well pause before submitting to a remedy almost as bad as their disease. But this kind of mercurial treatment is never necessary. Those cases of iritis commonly do best where the mouth has not even been made tender, and therefore there is no real necessity for the attempts that are being constantly made to treat iritis without mercury. We are often told that iritis will get well without it—and so no doubt it will, in a certain sense, get well without any treatment at all. But what is meant by 'getting well?' A wound gets well when a sufficient deposit of organisable material has taken place between the divided surfaces; and the denser the cicatrix, the more thorough is the cure. Or a case of hydrocele 'gets well' when the walls of the sac are thoroughly glued together by abundant inflammatory deposit. But the eye is in one respect a wholly exceptional organ. Once let its transparent tissues become opaque, and then, although the eye may in a certain sense have recovered from an inflammatory attack, the function of the organ is impaired or destroyed. The treatment of iritis consists in speedily preventing the formation of patches or films of inflammatory deposit in the transparent media of the eye, and if mercury has the invaluable property of doing this, it seems criminal in the surgeon to neglect the use of it.*

It is a curious fact that in certain persons the application of sulphate of atropia to the conjunctiva will set up all the symptoms of acute catarrhal ophthalmia. I do not speak of solutions to which a few drops of acid or of alcohol have been added. Such additions, I know, are sometimes made; but they are as unnecessary as they are irritating, for well-made sulphate of atropia is quite soluble in distilled water. The first instance of my meeting with this effect of atropine occurred several years ago, in a hospital in-patient who used drops from the same solution that was being dispensed at the time to many hundreds of others, none of whom experienced any similar inconvenience. As soon as the drops were discontinued, the conjunctival inflammation rapidly subsided, and it was again excited by a reapplication of the atropine. I have recently met with another case, in which great irritation, both of the eye and eyelids, followed the use of drops which I myself applied and knew to be perfectly neutral.

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* Remarks on the use of atropine in iritis almost identical with the above, were to have been added to the third edition of my *Guide to the Study of Diseases of the Eye*, 1866, but by inadvertence they were not sent to the printer.

SEQUELÆ OF IRITIS.

Besides the changes already mentioned as resulting from iritis, such as obstruction, or closure of the pupil, the inflammation is sometimes followed by degeneration of structure, which more or less involves the whole tissue of the iris.

Chronic iritis, for instance, in a cachectic subject, especially if the disease has been allowed to run on unchecked, is apt to induce a permanent thickening of the iris, all appearance of its normal fibrous tissue being lost, and the veins of the part becoming enlarged and irregularly dilated.

On the other hand, the constant pressure of a calcified lens, which has become thrust forward against the iris, will sometimes induce such wasting of its tissue, that the uvea wholly disappears, and the thin web of iris which remains allows the chalky-white lens to be distinctly seen through it.

Another consequence of iritis is the distension of the iris into *pouches*, which are formed in the following way. An attack of syphilitic iritis, left to itself, or badly treated, causes the whole margin of the iris to adhere to the capsule of the lens; the pupillary area being, at the same time, very small, and filled up with opaque deposit. All communication between the anterior and the posterior aqueous chamber is cut off; and the aqueous fluid secreted in the latter cavity, not being able to pass through the pupil into the anterior chamber, accumulates behind the iris, and gradually distends and presses it forwards; the pupillary margin meantime being prevented from advancing with the rest of the iris in consequence of its union with the capsule.

If the uveal surface, except just at the edge of the pupil, be free from adhesion, the whole anterior surface of the iris forms one convex mass, with a deep depression at its centre, in the position of the closed pupil; but if the uvea be here and there adherent to the capsule of the lens, the iris at those spots remains retracted, like the pupil, while intervening portions of iris are thrown into a series of pouches which may almost, or quite, touch the cornea. These pouched portions of iris lose their fibrous appearance, and have a dark slaty tint.

Vision, in such cases, is reduced to mere perception of light; but, provided the retina be sound, excellent sight can often be restored by means of a carefully-planned and skilfully-executed artificial pupil.

In cases of long-continued iritis, combined with disease of the choroid, and of the anterior portion of the sclerotic, the iris not only becomes united to the capsule, and bulges forwards in the manner just described, but the fluid secreted in the posterior aqueous chamber, continuing to accumulate, exerts pressure on the anterior portion of the sclerotic, and stretches its weakened tissue. This gradually yields, and forms a *staphyloma scleroticæ*, a tense bluish-black prominence, streaked with the widely-separated whitish lines of the sclerotic fibres. At first, while the prominence is small, it is usually situated at the upper part of the globe, just behind the cornea; but the distension may go on until the whole of the sclerotic, between the line of insertion of the recti muscles and the margin of the cornea, forms one bulging lead-coloured swelling. *Staphyloma scleroticæ* is always a sign of the deeper tissues of the eye having suffered from disease, and, if developed to any considerable extent, would contra-indicate operations for artificial pupil or cataract.

Cysts of the iris.—In very rare cases a punctured wound of the iris, near its ciliary attachment, has been followed by a cyst-like expansion of its substance, in consequence, apparently, of the fluid of the posterior aqueous chamber finding its way between the uvea and the fibrous tissue of the iris.

These cysts present a dark slaty tint, which nearly approaches to black when their walls become very thin. The treatment of these cases is often extremely troublesome, on account of the readiness with which the expanded iris-tissue reunites after being lacerated. When the lens is *in situ*, and transparent, the difficulty is greatly increased.*

OPERATIONS ON THE IRIS FOR ARTIFICIAL PUPIL.

Many of the diseases and injuries affecting the iris and cornea described in the foregoing chapters, produce complete closure o

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* See a case reported at length in my *Guide to the Study of Diseases of th Eye*, 2nd edit. 1859, p. 408.

Artificial Pupil must be understood to include not
ormation of a new aperture in the iris, when the porng the natural pupil has prolapsed through a breach nea, but also the reopening or the enlargement of the ipil when obstructed by inflammatory deposit; or the ent, towards a transparent part of the cornea, of a ch has become overshadowed and hidden behind a ieal opacity.

attempting any form of operation for artificial pupil, on must make himself thoroughly acquainted with y of the case, and especially ascertain for himself the conditions:

hether the eye perceives light: mere obliteration of not deprive the eye of this power, provided the retina ; for we know, by personal experiment, that even the of our closed lids does not prevent our noticing the a hand passing between our eye and the window.

ly, the presence or absence of the lens must, as far as e ascertained, and, if present, whether it is transparent .

, the cornea must be carefully examined, as to its transparency.

ly, the state of the iris itself must be noticed. The of chronic iritis would induce the surgeon to defer tion until the inflammation had ceased. A thickened ich all trace of its peculiar fibrous structure is lost, is unfitted for an operation, as it breaks away under the needlessly large cicatrix may seriously diminish the patient's field of vision.

Generally speaking, a small artificial pupil is more useful than a large one; that is to say, if it can be made in such a position that all the cornea in front of it is transparent. Sometimes, however, the pupil has to be drawn from behind an opaque corneal cicatrix; and in that case it is only by making a large aperture that a sufficient portion of it can be rendered available.

Inasmuch as the natural pupil is placed nearly in the centre of the iris, it would follow that a similar position must be the most suitable for an artificial aperture. Various considerations, however, may induce the surgeon to select a more peripheral situation; but he should always strive to approach the centre of the iris, as far as circumstances will allow.

Peculiar care is required in the examination of those cases, frequently brought under our notice, in which the greater part of the cornea appears converted into a more or less prominent, densely opaque, white cicatrix, after severe purulent or gonorrhœal ophthalmia. The patient may have good perception of light, and there may be an appearance of a narrow strip of semi-transparent cornea adjacent to the sclerotic, suggesting the possibility of an artificial pupil being made. And yet the appearance of true corneal tissue may be altogether deceptive.

When the whole cornea has been destroyed by ulceration, as in severe purulent ophthalmia of infants, or the gonorrhœal ophthalmia of adults, the iris is for a time laid bare; but very soon exudation takes place on its surface, while the iris, yielding to the pressure behind, gradually forms the prominence known as *staphyloma.* The greater part of this fibrinous coating of the iris eventually becomes white and opaque, and traversed by ramifying vessels; but the marginal portion of the iris is covered by a semi-transparent tissue, united, perhaps, to a very narrow ring of true cornea, just that portion immediately connected with the sclerotic. No space, however, exists between this semi-transparent, cornea-like tissue, and the fibres of the iris; and any attempt, therefore, to make an artificial pupil in this situation would only end in disappointment.

The different modes of making an artificial pupil may be classed under four heads: *laceration, incision, excision,* and *ligature.*

rawn back towards the corneal wound. This traction the ciliary attachment of the iris to give way; and when s has been separated to the extent desired, the hook is ed and withdrawn from the eye.

rtificial pupil of this kind involves almost all the faults ssible to include in one operation. Its position, opposite margin of the cornea, is the worst that could possibly be ; the size of the rent cannot be accurately limited; the and nerves of the iris are torn just where they are ; the great circular vein, surrounding the iris, pours out tity of blood, which partly or wholly fills the anterior r, and is not readily absorbed; if the lens be present, considerable risk of wounding it with the hook, which, ithdrawal, is frequently caught in the corneal incision. be hoped that this operation, if not already obsolete, edily be consigned to the limbo of exploded surgery.

cision.—This is the oldest form of operation for artificial eing that employed by Cheselden in a case commonly of as the first in which an artificial pupil was made. ration is founded on the elasticity of the fibres of the ich causes them to retract when cut across, so as to aperture for the transmission of light to the retina. t will be seen that the operation is likely to succeed in ion to the state of tension and retractile power of the will be inadmissible in those cases of closure of the on the stretch in consequence of so large a portion becoming healed into, and confounded with, the corneal cicatrix.

The incision is made either with a cutting-needle or a fine narrow knife, or else with scissors. The needle or knife is passed into the anterior chamber close to the edge of the cornea, and when the point has been carried a little beyond the middle of the iris, the cutting edge is turned backwards, the point is made to penetrate the iris, and its fibres are divided to such an extent as may be desired. The needle or knife is then rotated into its original position and withdrawn.

Maunoir [*] modified the operation by using scissors for dividing the iris; but of course they required a large corneal wound for their introduction, and neither the linear nor the V-shaped incision which he recommended was found by any means easy to accomplish when the iris had become flaccid after the escape of all the aqueous humour. If scissors are employed at all, the cannula-scissors, invented by Wilde, would be found far more convenient for incising the iris, as they may be so constructed as to cut their own way into the cornea, and fill up the wound they make, thus retaining a good deal of the aqueous humour.

In cases where a very narrow strip of cornea alone remains transparent, after sloughing or ulceration throughout the rest of its extent, it becomes of the utmost importance to accomplish the division of the iris with as little injury to the cornea as possible. In such cases I have found the most useful instrument to be a broad needle, cutting on both sides for a short distance from its point.

3. *Excision.*—In cases where the pupil had become drawn together, and its contracted area blocked up with an opaque membrane, in consequence of iritis, the lens being unaffected, the operation of incision, either by the knife or scissors, was contra-indicated, since it was hardly possible to puncture the iris with a cutting instrument without wounding the lens. The operation of excision therefore became necessary, which was performed as follows: an opening of sufficient size having bee made in the cornea, a forceps was introduced into the anterio chamber; its branches were then opened, a portion of iris wa included between them, and, being grasped, was drawn out o the corneal wound, and cut off with scissors. The objection t

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[*] *Mémoires sur l'Organisation de l'Iris et l'Opération de la Pupille artifici* Paris, 1812.

this operation was the difficulty of limiting the quantity of iris removed; the pupil was usually very large, and extended almost, if not quite, up to the border of the cornea.

The 'blunt hook,' invented by Tyrrell, introduced a more delicate and precise mode of operating; and, for special cases, has not been superseded by any subsequent contrivance. It requires only a very small corneal wound for its introduction; and it can be employed without risk in cases where the lens is *in situ* and transparent.

It is specially adapted for the following cases. First, when, after extraction, there has been extensive prolapse of the iris, so as to obliterate all but a very small vestige of the pupil. Secondly, when, in consequence of iritis, the whole pupillary margin has become adherent to the capsule, the peripheral portion of the lens itself remaining transparent. And, lastly, when the iris is perfectly healthy, but the pupil is hidden behind a dense central opacity of the cornea, the rest of the cornea remaining clear.

a. In a case such as I have alluded to under the first head, we will assume the lens to have been extracted through an upward section of the cornea. The artificial enlargement of the pupil would be made in the following manner: the lids being held apart with a spring-wire speculum, the surgeon steadies the globe by nipping up with a forceps a little fold of the ocular conjunctiva, just above the upper edge of the cornea; he holds in the other hand the broad cutting-needle, which he passes through the lower edge of the cornea, close to its junction with the sclerotic. If the width of the blade be properly proportioned to the size of the hook, a simple puncture will suffice; but if the needle be narrow, its edges may be used to enlarge the wound to a sufficient extent. The needle should now be gently withdrawn; not with a jerk, as such a movement is usually followed by a spurt of aqueous humour, and it is important to retain as much of that fluid as possible. The surgeon then takes the blunt hook, and passes it in through the corneal wound, the flat side of the hook coming in contact with the iris. The instrument, held in this position, is rapidly passed upwards, until its extremity reaches the small pupillary opening; then the handle is rotated so as to allow of the lower edge of the displaced pupil being firmly caught in the bend of the hook; gentle traction is then made, and at the same time the handle is again rotated in such a manner that the short bent portion faces directly forwards. It is only in this position that the hook can be wi drawn through the corneal wound without catching in it; it is for the want of attending to this little manœuvre that th who use the blunt hook so frequently find a difficulty in wi drawing it. When the hook, holding the iris, has been fai brought out of the wound, an assistant, with a pair of f scissors, snips through the iris, close to the hook, if a g portion of iris has been secured; but should the iris have t and only a small portion been withdrawn, it may be desir to cut through it close to the cornea. Sometimes the tissu the iris is so much softened that it breaks in coming out, then the surgeon must use a fine forceps to catch what rem and so prevent its retracting into the anterior chamber.

Any little shreds of iris that hang in the wound shoul returned by means of a little spatula, so that the lips o wound may come into exact apposition.

The description just given of the mode of using the blunt and of other details in the operation for artificial pupi apply to the different modifications subsequently described wire speculum, and forceps to steady the globe, will alwa found useful, often indispensable. The patient should lie on a couch; and the best light is usually obtained by th of the couch being turned towards the window; the su standing or sitting behind the patient's head. The chloroform will be regulated by circumstances; it is com necessary with children, or very intractable patients; b pain of the operation, when skilfully performed, is so tr that patients possessed of self-control can usually dispens chloroform altogether.

b. The next class of cases in which the blunt hook sho employed is that where iritis has terminated in adhesion be the whole or the greater part of the pupillary margin an capsule of the lens.

At p. 113, under the head 'Sequelæ of Iritis,' I have des such a condition of closed pupil, accompanied by a bulgin ward of the iris, in consequence of the pressure of the secreted in the posterior chamber of the aqueous hu When the whole surface of the uvea has become adher the capsule of the lens, these pouch-like dilatations of th do not exist. When only the extreme edge of the pupil ad the rest of the uveal surface remaining free, the cont pupillary area, blocked up with opaque membrane, re if a depression in the iris exists in either of these s, he may take advantage of the circumstance to the cutting-needle and hook between the cornea and out risk of wounding the latter.

, however, he has succeeded in catching the edge of the d drawing out a piece of iris, he may perhaps be disap- o find that he has removed only its fibrous portion, and aperture he has made is still blocked up by a layer of ment, adherent to the anterior capsule. Although in se the first operation may have done but little towards sight to the patient, it will be found to have greatly d a second operation, as the fluid which had been pent posterior aqueous chamber can now find its way into rior chamber, and, in consequence, the whole iris will ouched appearance, and recede from the cornea. When t irritation caused by the first operation has passed off, ing-needle may be introduced at a new point of the he edge of the artificial pupil caught with the blunt d drawn in such a direction as to remove a portion which had never been adherent to the capsule. If hery of the lens be transparent, this second operation nce open a way for the rays of light to pass to the

ensive ulceration at the centre of the cornea, stopping accordingly as he finds the outer or the lower portion of the cornea preferable in respect of transparency. The blunt hook is the most convenient instrument for effecting this displacement, as it does not endanger the lens, which I am supposing to be perfectly healthy. An opening having been made, either at the outer or lower margin of the cornea, in the manner described at p. 119, the free margin of the pupil is to be caught with the hook and drawn out, a larger or smaller piece of iris being cut off according to the size of the corneal opacity beyond which the pupil is to extend.

4. *Ligature.*—In spite of every precaution, it is not always possible to limit the size of the pupil, which sometimes opens out to an extent greater than was originally intended. To remedy this inconvenience, Critchett suggested an operation which he termed 'Iriddesis,'* and which is applicable to a limited number of other cases of artificial pupil besides that just described; as, for instance, where prolapsus iridis has occurred, and so much of the pupillary margin has been drawn into the cicatrix as to reduce the area of the pupil to a very minute aperture; or where the whole pupil has been displaced towards the extreme edge of the cornea, and there overshadowed by an opacity. A puncture is made through the cornea sufficient for the introduction of a cannula-forceps; a small portion of the iris near its ciliary attachment is grasped, drawn out through the wound, and tied there with a very fine silken thread. This transforms the pupil into an elongated slit. Should this aperture be found insufficient, it may afterwards be enlarged by tying a second portion of iris in such a position as to draw the pupil into a triangular form.

The operation by *ligature* has the advantage of leaving the margin of the pupil uninjured; and in some cases it has been found that even a certain amount of dilatation and contraction of the aperture has been maintained.

It is far from my intention, in treating of ophthalmic surgery, to attempt a record of all the schemes that have been suggested or put in practice. To describe the operations and instruments which artificial pupil alone has called forth, would be to enumerate a long and tedious catalogue of inventions, most of which have been long since abandoned as useless.

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* *Iriodesis* or *Iridodesis* would be a more correct word to imply tying ([illegible]) of the iris, inasmuch as the genitive of ἶρις is ἴριος or ἴριδος.

After-treatment of an artificial pupil.—The various forms of operation I have recommended in the foregoing pages, if skilfully performed, inflict so little injury on the eye, that, provided the parts be in a fit state to undergo the operation—all inflammation being extinct, and the patient's general health having been properly attended to—little more than repose of the eye is required to enable the cornea to heal; and when that is effected, the wounded iris soon regains its natural texture and appearance. We are often, however, obliged to operate on an iris which has undergone long-continued and repeated attacks of inflammation. The tissue of such an iris is soft and spongy, and its enlarged vessels, when torn or cut, pour out their blood into the anterior chamber, where it may remain for many weeks, or even months, without being absorbed. On the contrary, when the iris is sound, and the patient's health good, but little blood is effused into the anterior chamber, and that little commonly undergoes absorption in the course of a few days.

After an operation for artificial pupil, *both* eyes should be lightly bandaged, or the lids closed with strips of plaster. On the second or third day the eye may be examined. Should there be much sclerotic redness, or intolerance of light, the operated eye must be again closed for a day or two. In most cases, at the end of a week from the operation, a large eye-shade will be sufficient; but the patient must be warned against too soon exposing the eye to strong light; and if the case be one in which the patient has for several years been limited to perception of light, he must be forbidden to strain his newly-regained powers of sight by premature examination of small objects. A pair of tinted glasses should be worn for some time after he has begun to go out of doors.

If the operation has been performed under chloroform, it will not be advisable to give any opiate or narcotic at night; but in excitable patients, who have not taken chloroform, it is sometimes necessary to give some mild narcotic. From twenty-five or thirty minims to a drachm of tinct. hyoscyami, in camphor-mixture, is what I usually order as a night-draught for an adult who has not been habitually addicted to the use of opiates. But many patients do not require anything of the kind. There is no reason for denying the patient a moderate quantity of plain animal food on the day of the operation, as well as on the following days. Nor should stimulants be wholly forbidden to those who are accustomed to their daily use. I need hardly say that a patient who is to spend the first day after the opera-tion in bed, and perhaps the rest of the week in the house, i not to live as freely, and have the same amount of stimulants as if he were taking daily exercise, and were engaged in acti pursuits. But, on the other hand, it is absurd to keep a pati on low diet, and deprived of all accustomed stimulants, becau a small puncture has been made in his cornea, and a little of his iris removed. Old and feeble persons cannot bear reduction; and if any considerable quantity of blood has escap into the anterior chamber, the best way to hasten its absorp is to keep the patient's powers up to a healthy stand by plain nutritious diet, and just such an amount of stimul as will maintain the circulation at a proper point of vigour.

It is difficult to conceive how surgeons who wrote and p tised within the last forty years, could have thought it neces to resort to the depleting and starving treatment we find th recommending as necessary, after the operation for an artifi pupil. Little more than forty years ago, the late Mr. Guthri in a work professing to teach the operative surgery of the e wrote as follows: 'As a general rule, the patient should *bled largely after any of the operations* for the formation of artificial pupil;' and he goes on to say, that this bleeding is be to the extent of fourteen ounces, in some instances to twen four, or from that to thirty ounces; that if the diminution pain be only temporary, and after a few hours begins to incre [which, in an irritable or neuralgic patient, it would be q sure to do, after all this loss of blood], recourse must again had to bleeding; and that if *this* should not be sufficient arrest the progress of the disease, it must be immediate treated as a case of iritis, and mercury administered in such manner as to affect the system as rapidly as possible.

Such was the treatment by which a simple, delicate, a almost painless operation was perverted into a cause of sufferi and misery.

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* *Lectures on the Operative Surgery of the Eye*, 2nd edit. 1827, p. 510.

nonyms at the head of this chapter—and their number e greatly multiplied by quoting from the older writers on ases—will at once show the difficulty that has always in assigning definite terms to those defects of sight epend upon diseased states of the choroid and retina.

e some writers have classified these diseases *subjectively*, are evidenced to the patient by his own perceptions, and oken of 'impaired vision,' 'amblyopia,' and 'amaurosis,' ave attempted an anatomical arrangement, which before ntion of the ophthalmoscope was purely speculative and y, and have assumed inflammation of the choroid or o be the material *objective* cause of the phenomena.

ophthalmoscope has already dissipated much of the which formerly surrounded the deeper tissues of the nd has enabled us to demonstrate morbid changes, the stence of which could only be vaguely suspected before thalmoscope was invented. But when we remember siderable a portion of the visual apparatus is contained the cranial cavity, there must always remain a large defects of sight, which, like other cerebral diseases, can nly of a theoretical and uncertain diagnosis.

iditis.—Of course a structure like the choroid, almost composed of a mass of blood-vessels, cannot fail to play rtant part in all hyperæmic conditions of the eyeball.

active, and every tissue presenting the aspect of perfect health; and yet the ophthalmoscope may at once reveal morbid changes, which could only have been produced by extensive and long-continued disease of the choroid, portions of this structure having undergone atrophy to such an extent as wholly to have disappeared, leaving the sclerotic exposed to view; masses of pigmentous deposit overspreading the greater part of the choroidal surface, or effusion of serum having occurred in such quantity as to have detached a considerable portion of the retina from its position.

Retinitis.—As with the choroid, so it has fared with the retina, in respect of its supposed diseases and their symptoms. In the older ophthalmic works precise and distinctive descriptions are given of the symptoms of retinitis, which we now know to be altogether fanciful and imaginary. One of the most extensive forms of retinal inflammation, that originating in syphilis, is proved by the ophthalmoscope to be a not unfrequent associate of the disease which still retains the restricted name of 'iritis;' and yet, while this syphilitic inflammation of the retina is going on, there are none of the symptoms of retinitis, as formerly described by ophthalmic writers.

In patients who have long experienced impairment of vision, terminating in total loss of perception of light, the ophthalmoscope not unfrequently exposes to our view an amount of deposit on the retina, both opaque and pigmentous, such as could only have resulted from active inflammation; and yet, the progressive failure of sight has been painless, and quite unattended by any symptoms analogous to those formerly received as indicating retinitis.

If it be said that these are instances of *chronic* inflammation, and that the *acute* form must certainly be attended with all the phenomena of hyperæsthesia of the retina, the ophthalmoscope again contradicts the old opinions. Cases occur in which a sudden cloud appears to come before one eye, shrouding all objects in a dense mist, or wholly destroying the perceptive power of a large portion of the retina. No pain whatever occurs in the eye, nor is the patient sensible of any luminous appearances; while the iris and all superficial parts remain perfectly unchanged. Let the pupil be dilated, and the ophthalmoscope applied, and the greater part of the retina will be seen overspread with blood, poured out from some ruptured retinal vessel; and yet the hyperæmia, which must have preceded such rupture, may have been unattended with any subjective sensations of light.

In fact, the terms *retinitis* and *choroiditis* originated in a desire to apply a precise and anatomical nomenclature to morbid conditions altogether obscure. Before the invention of the ophthalmoscope, this nomenclature passed unchallenged; for neither the active disease, nor the morbid changes resulting from it, could be investigated in such a manner as positively to prove or disprove the surgeon's diagnosis; and he pronounced a case to be choroiditis or retinitis, according to the preconceived notion he might have formed as to the effects which such inflammations would produce on vision.

The term 'amaurosis,' which but a few years ago formed a heading to the longest chapter in every work on eye-diseases, and a title to many an elaborate monograph, must now be consigned to oblivion; unless it be retained to designate those conditions of dim or lost sight the causes of which, being within the cranial cavity, are therefore beyond the range of actual inspection.

Morbid Appearances of the Retina, Optic Nerve, and Choroid.

Any verbal description of the various changes in the deep tissues of the eye, which the ophthalmoscope exhibits to our view, must of necessity be very imperfect; such a description may, indeed, recal to memory peculiarities of form and colour which have already been studied in the living subject; but to the beginner it can suggest only a faint and shadowy picture. In many instances, too, we must content ourselves with describing appearances, the real nature of which we are at present unable to explain.

Retina and optic nerve.—In old persons, whose dimness of sight would suggest the existence of commencing cataract, we occasionally find a *white patch* of variable extent, and very irregular outline, immediately surrounding the optic nerve. Sometimes this patch is of such extent as to encroach upon that portion of the retina corresponding to the axis of vision. These patches are of an opaque dead white, and are quite devoid of vessels. They seem to be due to chronic hardening and condensation of the nervous tissue, with obliteration of the vessels. In some instances, perhaps, fatty degeneration may also be present.

In several cases of Bright's disease, accompanied with gre dimness of sight, yellowish-white spots have been seen scatter over the surface of the retina. I am acquainted with only on case in which the fatty nature of these deposits has been prov by dissection.*

The changes in the retina and optic nerve consequent up syphilitic inflammation have been already noticed in the sectio on iritis (p. 107).

A very remarkable appearance connected with the optic nerv in myopic persons, consists in a white patch, of a crescentic shap so immediately in contact with the margin of the nerve as to seem at first sight to form part of the nervous tissue itself. The nerve i these cases is always found to deviate from its normal circul form, and to assume more or less that of an oval, in contact wit the narrow diameter of which the white patch is found. As a rul it is placed to the outer side of the optic nerve, but it may b found above, below, or to the inner side. This crescentic patc has been described by German writers under the name of 'staphyloma scleroticæ posticum,' from a supposition that there is always at this spot an actual protrusion of the sclerotic.† This does not appear, however, to be invariably the case.

In an eye which presented the crescentic patch in a very marked degree, it was found on dissection that the pigment-cells of the choroid were altogether wanting throughout the whole extent of the crescent; so that the light from the ophthalmoscope, passing through the transparent retina and wasted

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* The case is reported by Heymann, in the *Archiv für Ophthalmologie*, vol. ii. p. 139, 1856. During the progress of the disease the patient became maniacal, so that the ophthalmoscopical examination was difficult. The loss of sight was almost total in both eyes. The media were clear, and an irregular yellowish-white patch was observed just below the optic nerve. Both eyes were examined after death, and presented nearly similar appearances. At a distance of a line or two from the optic nerve, about twenty yellowish-white spots, of various sizes, were arranged in an irregularly circular figure. The largest spot which had been seen during life was situated below the optic nerve, and about a millimetre in diameter. A microscopical examination of the spots, proved them to be isolated portions of fatty degeneration in the ganglionic structure of the retina.

† E. Jæger, *Beiträge zur Pathologie des Auges*, 1858, plate. xvii. A representation is here given of a well-marked crescent, fringed with pigmentous deposit, which was observed in a very short-sighted patient. Plate xviii. shows a still larger crescent, in a case of more advanced myopia. This figure also exhibits the choroidal vessels with that extreme distinctness which is caused by absence of the hexagonal pigment.

vas reflected from the sclerotic itself, which at this
s thinner than natural, but not at all prominent or
natous.*

the more striking appearances under the ophthalmo-
the irregular deposits of *black pigment* on the illu-
field of the retina. These pigmentous deposits present
arieties as to quantity and mode of arrangement. In
two or three minute isolated dots may alone be visible;
er case the pigment may assume the form of fine
ramifying over a considerable portion of the retinal
while, in a third case, the pigment may be aggregated
black masses, the intervening portions of retina being
y appearance. (Plate II. fig. 2.)

ntous deposits are met with at all ages, and generally
be a sequel of chronic inflammation, although it very
ppens that the patient can give no account of such an
Pigment is also commonly seen interspersed in large
s among the white patches which result from syphilitic
f the retina.

a vessel, in either the choroid or the deeper portion of
a, has given way, and broken up the tissues immedi-
rounding the extravasation, absorption of these tissues,
s of the blood, may subsequently take place to such an
s to lay bare the sclerotic. A rounded white patch is
duced, which is usually fringed with a black edge of
. In other cases the whole site of the extravasation be-
vered with pigment, so that, instead of a black ring, an
black disk is the result. I have met with several in-
n which a fringed or blackened patch of this kind was
directly in the axis of vision. Sight was very imperfect,
ted to a very small space; so that, in the attempt to
rge type, only a single word, or part of a word, could be
at a glance.

vasations of blood, either from the retina or the choroid,
te, I need hardly say, the most serious accidents to
ose tissues are liable. The blood may be effused in

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plate in the first volume of the *Ophthalmic Hospital Reports*, figs. 4
e nerve in both these figures is over-coloured, so as to present too
contrast to the whiteness of the crescent. The dissection by Dr.
ded to above, will be found at p. 117 of the volume just quoted.
esentations of the myopic patch in various forms are depicted in
Liebreich's *Atlas*.

consequence of a blow on the eyeball, or it may escape spo taneously from a distended vessel giving way, as in ordin apoplexy.

It is remarkable that rupture of a retinal vessel someti occurs without any of the symptoms which one might exp would accompany it—such as giddiness and other signs of ce bral disturbance. I have seen many cases in which a dim or cloudiness has suddenly overspread one eye, while the pati in apparently good health, was quietly engaged in reading o writing; no pain or uneasiness of any kind accompanying th attack, the iris retaining its mobility, and even the conjunc and sclerotic showing no trace of increased vascularity. Th patient finds that a considerable portion of his field of vision h become a total blank as regards perception of objects; whi perhaps, he still retains the power of dimly discerning tho which happen to fall on some limited portion of the retina. such a case is examined within a few hours, or even a few da after the rupture of the vessel, the fresh red colour of the effu blood will at once be recognised. If it is one of the radiat vessels of the retina that has given way, the prognosis will much more favourable than if the hæmorrhage had come f the choroid; for, in the former case, the tissue of the ret although for a time overspread with blood, and so rendered capable of receiving visual impressions, may have escaped serious disintegration; whereas, if the blood has proceeded f the choroid, it may have actually ruptured the retina, and i parably destroyed that portion of it as far as its function is cerned. The presence of clots freely floating in the vitr humour would be a still more unfavourable sign, as it w prove that the tissue of the vitreous body had, to a certain tent, been broken up. This latter complication more freque results from blows on the eyeball than from spontaneous plectic extravasation.

No one who has had a little practice with the ophthalmos can find any difficulty in detecting a recent extravasatio blood on the surface of the retina; but the recognition of changes which mark the site of old extravasations is often tremely difficult. I have already noticed the cases in whi rupture of choroidal vessels breaks up and destroys a lim portion both of the choroid and retina, leaving either a defined space of white sclerotic, or a patch of dark pigmen mark the site of the disruption. But a less extensive extr

inating in the rupture of a superficial vessel of the
leave such faint traces as almost to escape observa-
etimes the site of the rupture is marked by a slight
ain, in other cases by a faint mottling of the retinal
ile a more extensive extravasation may so far damage
s to leave in after-years a linear or stellated cicatrix
so term it), of a lighter colour than the surrounding

fusion between retina and choroid.—This effusion may
esult either of acute or chronic inflammation ; *chronic*
ween the retina and choroid may take place in the
al and insidious manner, so as only to manifest itself
ent of vision, unattended with any pain or external
lammation.

e retina has become detached to a very considerable
orresponding portion of the field of vision becomes a
so far as perception of objects is concerned ; while
n of the retina which remains in apposition with the
y still distinguish even small objects, although in an
nd partial manner.

e no external signs by which we can ascertain the
f effusion beneath the retina. The ophthalmoscope
les us to detect it.

sed fluid may either exist in such a small quantity as
ces to impart a cloudy appearance to a limited portion
a ; or it may have detached a considerable extent of
or even the whole of it, from its connection with the

e limited effusions frequently occur in the immediate
ood of the optic nerve. At first sight they appear as
cloudy patches in the midst of healthy tissue, and
ng vessels which are spread out over the rest of the
he eye appear to be lost when they arrive at the edge
h. This appearance is owing to the fact of the vessels
d up by the effusion beneath them, so that they are
different from that of the vessels of the healthy retina.
ovement of the convex glass, which the ophthalmo-
rver is employing, will at once bring into focus the
rlying the effusion.

large portion of the retina has been separated, it
he appearance of a lobular mass, of an opaque greyish
trasting in a remarkable manner with the reddish

surface of that part of the retina which still retains its natural position. Sometimes the lobular mass may be observed to oscillate with each movement of the eye; and when brought into focus the surface of the mass is seen to be overspread with ramifying vessels, the displaced veins of the retina.

When almost the entire retina is detached from the choroid, the appearances under the ophthalmoscope are at first very difficult to understand. The whole fundus of the eye appears at one moment of a dull grey, as if covered with a milky gelatinous deposit; then the white disk of the optic nerve comes for an instant into view, and then again a sudden turn of the eyeball affords a glimpse of some very limited portion of undisplaced retina, which still dimly reflects the luminous rays which fall upon it. Not unfrequently the view of the fundus is still farther confused by floating bodies dispersed through the vitreous humour.*

Coloboma of the choroid.—This very curious congenital malformation is associated with coloboma iridis (p. 92), and it presents under the ophthalmoscope a most remarkable appearance. The optic nerve is with difficulty distinguished, as it is in the midst of a large, oblong patch of white, across which some long scattered vessels are seen to ramify. This white patch is the sclerotic, exposed to view by the great gap in the choroid. The sheath of the optic nerve is also said to be imperfect in these cases.†

Optic nerve.—I have already described the appearance of this nerve in health, and have incidentally noticed a few of its morbid changes, such as are found in connection with myopia, and with syphilitic inflammation of the iris.

Very great variations in the form and colour of the nerve are compatible with good sight. As age advances, the tissue of the nerve appears to become denser, less succulent, so as to occupy a smaller space than in early life. Its colour also becomes darker, and in some old persons approaches to grey, while its outline slightly deviates from that circular form which one must assume as the standard of perfect health. Indeed, it is extra-nary to see how much variety in its size, form, and colour co-exist with a fair amount of vision.

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* It is almost impossible for an artist to give a correct representation of a detached retina. A very able attempt to do so, and indeed the only one have seen which has any resemblance to nature, is in Liebreich's *Atlas*, tab. vi fig. 2.

† Liebreich, tab. xii. fig. 5.

very common appearance is that of a thin line of black nent skirting the margin of the optic nerve to the extent of xth, a quarter, or the half of its circumference. Strictly king, we must regard this pigmentous deposit as morbid; its existence cannot be of any great importance, inasmuch e so frequently meet with it in eyes which, if judged by r power of vision, may be termed healthy.

flammation ('optic neuritis') attacks the nerve in various s. Sometimes it is evidenced by extreme hyperæmia, the e disk assuming a pink or reddish colour. After this red- has existed a considerable time, attended with great dim- of sight, it slowly passes off, but the nerve does not resume ealthy aspect. On the contrary, it either presents a dead appearance, or a dirty-grey tint; in either case the blood- ls remain much diminished in size, and vision is almost or ether lost.

is form of optic neuritis is occasionally met with as a result cessive indulgence in tobacco.

at too great use of this narcotic has, in certain constitu- , a direct tendency to induce disease in the optic nerve, can nger, I think, be doubted. I say 'in certain constitutions,' is notorious that a vast proportion of those who smoke co do so with impunity so far as sight is concerned.*

other form of neuritis either co-exists with syphilitic iritis, liable to come on several weeks or months after all inflam- ry appearances in the iris have passed away. The area of upil may be quite free from deposit, there may be no trace

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ly limits do not permit me to enter fully upon this most important t, but I will mention just one case, on account of its peculiar circum- s A literary man, of large and active brain, a voluminous writer on l topics, came under my care for gradually diminishing reading-power. d been for years a hard worker, reading and writing many hours each day. obby was tobacco-smoking, which he believed to be essential to the due of his intellectual powers, and except during the time devoted to sleep meals, the pipe was seldom laid aside. He wrote a history of tobacco, eld public disputations in defence of its use. He lived by his pen, and he began to find reading and writing a little difficult, he only smoked the . I found all the media clear, both optic nerves small and anæmic, and etinal vessels diminished in size. He could no longer read ordinary type, when I last saw him he was compelled to give up literary pursuits ether.

of redness in the sclerotic, and yet the sight becomes as dim as it was during the height of the iritic inflammation. In such a case the ophthalmoscope alone can enable us to form a diagnosis. The optic nerve is either wholly hidden by a filmy cloud of lymph, or its outline can be dimly traced through the cloud, which not only involves the optic disk itself, but obscures the adjacent portion of the retina. If a case of this kind is neglected, the lymph eventually forms an opaque white patch overspreading the optic nerve, and, according to the amount of deposit, sight is either greatly obstructed or wholly destroyed. If the case be seen at an early stage, a careful mercurial treatment, either with or without iodides according to circumstances, may cause complete absorption of the lymph.

One of the most remarkable changes to which the optic nerve is liable, is that observed in cases of blindness from cerebral disease, involving that portion of the nerve which is contained within the cavity of the skull. In old-standing cases of thi kind we find evidences of chronic congestion of the retina, a degeneration of the optic disk. The fundus presents a unifor red colour, sometimes so strongly marked that no trace separate choroidal vessels can be seen, and the vessels radiatin from the centre of the nerve are almost lost in the deeply-tint surface on which they lie. Contrasting strongly with the re ness surrounding it, the optic nerve at once attracts attenti by its extreme whiteness, which resembles that of ivory, rath than the creamy or faintly pinkish tint which I have describ as characterising the nervous tissue in a state of health. The dense-looking, homogeneous nerves have undergone *wh* *atrophy*, and have lost the greater portion of their true nervo element, little more than the fibrous tissue remaining. (Pl III. fig. 2.) The combined appearance of a red, thickened retin and a homogeneous, white, optic nerve, at once assures t practised observer that the case is quite beyond recovery.

In a practical point of view there is no change in the opt nerve more important than the pitting or *excavation* which connected with glaucoma. This appearance can be well se only in the early stage of the disease, for after a while a chan in the corneal epithelium takes place which prevents any cle view of the fundus of the eye. When the concavity of the ner is considerable, the retinal vessels are seen to bend abruptly they are passing over the edge of the depression. (Plate I. fig.

olour of the nerve is at first not much altered, but after a t assumes a greyish tint, which, under certain conditions umination, appears darker than it really is. These ges will be again alluded to in the chapter on glaucoma.

ses of greatly impaired sight are met with in which the nerves are found as deeply excavated or cupped as in the advanced stage of glaucoma, while there is an absence of e other signs of this disease; the corneæ being clear and th, the irides active, and the globes not harder than al. Simple wasting (*grey atrophy*) of the nerve seems to e cause of its concave appearance.

rophy appears sometimes to affect the whole retina and nerve, without any previous inflammatory process. This tion is chiefly met with in old persons; it also may befal in the middle period of life. The power of sight ually fades away year by year, until eventually mere peron of light remains. The ophthalmoscope reveals a per- clear condition of the media, and at the same time affords a complete view of the choroidal vessels, that the observer almost fancy the retina to be altogether absent. The nerve is small and shrunken, irregular in its outline, and dark grey or drab colour; and the vessels emerging from m delicate, hair-like, red lines, barely traceable across the of the illuminated choroid.

some instances I have seen this extreme atrophy of the a accompanied with a very remarkable change in the idal vessels, their colour being pale orange or buff, instead d.* This appearance I have met with only in old people; heir failure of sight has been so slow, and unattended with ed symptoms of any kind, that they have been supposed to e subjects of steadily advancing cataract.

eatment.—If the reader now refers back to the sketch I given of the morbid changes in the retina and choroid, he at once perceive how impossible it must be to lay down rules for treatment that will be uniformly applicable to all lled 'amaurotic' cases. In a group of patients, coming of almost the same defects of sight, one will be disred to have a portion of the retina overspread with blood; second, the axis of vision will be occupied by a patch of pigment; while in a third, the retina and choroid will be partially separated by serous effusion.

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* See E. Jäger, *Beiträge zur Pathologie des Auges*, taf. vi.

Are these three patients to be treated alike? Do they, in fact, possess anything in common? And yet formerly they would all have been classed together as 'amaurotic,' and probably have undergone salivation accordingly.

If the ophthalmoscope had done nothing else than limit the wholesale administration of mercury in eye-diseases, it would have conferred an immense boon upon mankind.

Even when it has been ascertained that an extravasation of blood has taken place from the vessels of the retina or the choroid, the treatment will require great care and discrimination on the part of the surgeon. In one case the extravasation will have been accompanied, or immediately preceded, by giddiness and other symptoms of disordered circulation in the brain, and may have been induced by alcoholic or other stimulus, or by great muscular efforts in a plethoric and vigorous subject. Rest and abstinence may be indicated as the first preparatives for treatment. In another case, rupture of a retinal vessel may have occurred in a feeble and delicate patient, during a period of perfect repose, and may have resulted from a diseased and softened condition of the coats of the vessel itself. I have seen extravasations take place in such subjects in consequence of sudden exposure to cold, especially when the body or mind had been previously much exhausted. Here, moderate stimulants would be beneficial, and the absorption of the effused blood would be hastened by medicines of a tonic character—iron or quinine.

In all cases of extravasation of blood from the vessels of the retina, the surgeon should take care not to make unnecessary examinations with the ophthalmoscope, as each occasion of exposure to its strong light increases the congestion of the part, and consequently the liability to farther extravasation. I have known several instances of this kind, in which a fresh escape of blood immediately followed the use of the ophthalmoscope. Having once clearly made his diagnosis, the surgeon may be satisfied as to the progress of absorption by the steady improvement of the patient's sight, and may postpone any farther use of the ophthalmoscope until recovery has been well established.

Where serous effusion has taken place between the choroid and retina, in addition to other general treatment, iodine internally, combined with blistering in the neighbourhood of the eye, may be tried; although, if the effusion be of old standing, and to a large amount, little, if any, benefit can be hoped for.

It must be evident that structures, like the choroid and retina, which derive their supply of blood from such remote and deep-seated sources, cannot be treated by local depletion, even if depletion were desirable. The surgeon must seek to restore the balance of the patient's circulation by general treatment, based on a careful and comprehensive survey of constitutional peculiarities and mode of life, and especially of the habits or pursuits which may be supposed to have given rise to the local changes. Inquiries must be instituted as to the existence of any of those causes which impair the sight by exhausting the patient's general nervous power. The abuse of alcohol, tobacco, or opium; venereal excesses; protracted suckling, and many other depressing agencies, will suggest themselves to the mind of the acute practitioner. He will take care not to trust too implicitly to this or that article of the pharmacopœia, and will especially be on his guard against the depressing agency of mercury—the drug which he will find lauded almost as a panacea for 'amaurosis' in some of the medical works of the last generation.

Galvanism and strychnine he will frequently hear spoken of as possessing wonderful efficacy in arousing the dormant powers of the optic nerve. The action of strychnine appears so entirely limited to the motory fibres of the nervous system, that to expect it to influence a nerve of special sense is to confuse all our notions of physiology. Galvanism has been at various times a favourite remedy with the public, and its administration admits of a parade of scientific apparatus which specially imposes on the popular mind.

Those who believe—or make their patients believe—that they can render cataractous lenses transparent by means of galvanism, will doubtless long continue to vaunt its efficacy also in cases of the most complete disorganisation of the retina.

An anatomical classification of eye-diseases—the arranging of them, that is to say, according to the changes of structure which cause the impairment of sight—has such obvious advantages that it has become almost universal among ophthalmic writers; but it has the inconvenience of offering no heading under which to place certain defects which cannot be precisely demonstrated as originating in any one part of the optic app ratus.

Of this kind are the various luminous appearances depend upon some temporary disturbance of circulation—occasio obscuration of half the field of vision (*Hemiopia*)—the conditi termed *Hemeralopia*—congenital inability to distinguish certai colours—spectral illusions, &c.

Faulty perception of colours.—The following list compri only a portion of the many terms invented to designate th affection: *achromatopsia, chromatopseudopsia, chromatometablep sia, chromatodysopsia, chromatopseudoblepsia, dyschromatopsi* These words, it will be observed, all imply difficulty or inabili to *see colours*; but in fact the subjects of this affection are n insensible to all, but only to some colours, while others are se perfectly. The term *colour-blindness*, employed by Wilson,[*] i on this account objectionable. *Daltonism*[†] commemorates the faulty perception of an individual, without conveying any noti of the nature of the defect. I have suggested the word *acritochromacy,*[‡] as implying 'inability to discriminate between colours,' which pretty nearly defines the true nature of the affection.

On investigating the reported cases of 'acritochromacy,' the defect appears in most instances to resolve itself into inability to perceive red; and the compound tints suggesting doubtful impressions are those into which red enters to a greater or les extent. Yellow seems to be always appreciated, and blue almos always.

The cause of the defect probably resides not in the eye itself but in that portion of the brain to which the impressions o light are ultimately conveyed. Hitherto very few dissectio have been made of the eyes of 'acritochromatic' person Dalton had supposed a blue tint of the vitreous humour to the cause of his own peculiarity, and, in accordance with h express wish, his eyes were examined after death, but nothi unusual was discovered.

Acritochromacy may take place as a temporary morb symptom.

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[*] See *Monthly Journal of Medical Science*, Edinburgh, July 1854, p. 1.

[†] From Dalton the chemist, who published his own case in the *Memoirs the Literary and Philosophical Society of Manchester*, 1798, vol. v. p. 28.

[‡] Ἀκριτοχρωματία.

oness and formication in the left leg and foot. I enjoined complete prescribed iron in small doses. Within a week she could trace lines streaks, but was quite unable correctly to appreciate colours. She had lty with yellow and blue, but mistook all tints containing red. Ten days general health was restored, and with a little pains she could read of a leading article in the *Times*; but her appreciation of colours was rfect. At the end of a few weeks all defect of sight was gone; she smallest type, and her power of discriminating colours was quite

on has insisted upon a very important practical point ed with 'colour-blindness,' as he terms the defect, , that persons employed on railways and elsewhere, oloured lights are used as signals, should be previously as to their power of perceiving colours with perfect y. On many occasions our lives depend on the ability solitary signal-man to distinguish between green, the safety, and red, that of danger. Now that an universal system has forced upon us a mode of travelling fraught essant peril to life and limb, we cannot afford to neglect chance of safety.

e seems to be no cure, or even palliation, of a defect ppears to depend upon a congenital want of appreciative n the brain itself.

ralopia—literally 'day-sight'—is a term used to de- a peculiar form of intermittent blindness, the subjects h see perfectly in broad daylight, but lose all power of ing objects as soon as the sun has set, and twilight com- . The persons in whom the affection is most frequently weaker stimulus of twilight or moonlight. Exposure to tropical light, however, is not the sole cause of the affection; for I have met with it in persons who had never quitted the temperate regions of the globe; but in most of these latter cases the complaint had shown itself after long voyages, which had subjected the patients to exhausting toil and exposure to severe weather, while deprived of a proper supply of fresh provisions and vegetables.

In these latter cases I have commonly found that a few weeks' residence on shore, with a mixed vegetable and animal diet, and the use of quinine, has restored vision to a healthy state.

Nyctalopia—'night-sight'—would imply inability to see by daylight, the exact converse of hemeralopia. In a certain sense, patients affected with that irritable form of corneal inflammation commonly called 'strumous ophthalmia,' might be termed nyctalopic, so unable are they to bear strong light, and so willing to open the eyes and look about them in the dimness of twilight; but, apart from inflammation, I have never met with nyctalopia to the extent described by authors; and I am inclined to consider the affection an imaginary one, invented, as it were, to form a companion disease to the hemeralopia just described.

CHAPTER VIII.

DISEASES OF THE VITREOUS BODY.

Before the invention of the ophthalmoscope, little was known about the morbid conditions of the vitreous humour. It was frequently found to become diffluent (*synchysis*) after injuries to the eyeball, and during the progress of certain chronic inflammations; and it was assumed to play an important part in glaucoma. The ophthalmoscope presents to our view a great variety of morbid products in the humour, which it is difficult to observe with accuracy, on account of the rapidity with which many of the flakes, filaments, and corpuscles, float about with every movement of the eye.

When *hæmorrhage* occurs from the ciliary processes, or from the superficial vessels of the retina, a portion of the clot not unfrequently becomes entangled in the vitreous humour, and orms an irregular, filamentous, black-looking* body, floating o and fro across the illuminated field of the ophthalmoscope.

In *syphilitic inflammation* of the deep tissues, the vitreous humour loses its perfect transparency, and becomes turbid; and in severe cases, flakes of lymph are seen freely moving about in it, like tangled blackish threads.

A very singular phenomenon connected with the vitreous humour is that termed *sparkling synchysis* ('synchysis étincelant'), produced by the disintegration of an altered crystalline ens. This body, after becoming opaque from ordinary cataractous change, sometimes undergoes extensive fatty degeneration, crystals of cholesterine being abundantly formed within its substance. If a lens in this condition is broken up with the needle, or becomes ruptured and thrown down to the bottom of the vitreous chamber by a blow, the crystals of cholesterine are set free, and at each movement of the eye appear as innumerable brilliant points, like the finest gold-dust, sparkling in the dark area of the pupil. When the eye is kept at rest these crystals gravitate to the bottom of the mingled aqueous and vitreous humours, some sinking down behind, and some in front of the iris.

Sparkling synchysis is very rare, and I have not had an opportunity of examining any cases with the ophthalmoscope.

Cysticerci.—Perhaps the most striking phenomenon connected with the vitreous humour is the presence of entozoa, either freely floating within it, or protruding into it from the surface of the retina, to which they are attached. By far the greater number of cases of this kind which have been recorded are to be found in foreign journals, for hitherto only a very few have been observed in this country. I have myself never met with a case.†

Of twenty cases reported in various numbers of the *Archiv für Ophthalmologie*, the majority appear to have been under the care of Graefe. In *eight* cases the cysticercus was either e bedded in the very tissue of the retina, or firmly adherent its surface; in *six* cases, the creature appeared to be behind t retina; while in *six* others it was quite detached, and floa freely in the vitreous humour. This latter circumstance indu Graefe, in two instances, to attempt its removal; in the f case, making an incision in the sclerotic and passing in a for ceps through the wound; in the second, adopting a slower a more complicated proceeding. First, a portion of the iris w excised, so as to make a large artificial pupil; then, when t irritation had subsided, the lens was extracted through a fla section of the cornea; and lastly, after a considerable interv of time had been allowed to elapse, a forceps was introduc through a fresh opening made in the cornea, and the cysticercus grasped and drawn out.*

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* I may here notice that floating bodies in the vitreous humour are not necessarily *black* because they look so under the ophthalmoscope. Any body sufficiently opaque to intercept the rays of light passing from the illuminated retina to the eye of the observer will appear black, although if examined out of the eye, it might be found light-coloured or even white.

† Teale gives the history of a case occurring in his own practice in 1864 (*Ophth. Hosp. Reports*, vol. v. p. 318). Bowman reports another (op. cit. vol. iii. p. 324). Hulke, in dissecting a disorganised and irritable eye, found a cysticercus between the choroid and retina.

From a review of all these cases, it appears almost certai that the cysticerci found loose in the vitreous humour had attained that position by perforating the retina, having bee originally formed between that tissue and the choroid, in whic situation it seems that all the cysticerci above described wer originally developed.

In a more recent volume of the *Archiv*, Graefe gives the tot result of his experience as to the occurrence of cysticerc (xii. 2, 174; 1866). During thirteen years 80,000 patien had attended his clinique, and among them rather more tha 80 cases of cysticercus in the deep tissues of the eye had bee observed: 3 had been seen in the anterior chamber; 5 unde the conjunctiva; 1 in the substance of the lens; 1 in the orbi The ages of the patients varied from eight years to seventy.

The very curious researches recently made into the natur history of intestinal parasites have proved that the *cysticerc telæ cellulosæ* and the *tænia* are really the same creature i different stages of development.†

I believe it has been well ascertained that the inhabitants Northern Germany are more liable to tape-worm than those the British Islands, and this circumstance would account f the fact of the cysticercus having been so much more frequently met with in the former country.

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* A case of cysticercus in the vitreous humour is related by Desmarres, *Tra théorique et pratique des Maladies des Yeux*, 2nd edit. 1858, vol. iii. p. 75 Another by Williams in the *Cincinnati Lancet and Observer*, May 1858. S Liebreich's *Atlas*, tab. vii. figs. 5 and 6.

† See Küchenmeister and Von Siebold, *On Animal and Vegetable Parasi* (Sydenham Society, 1857).

Muscæ volitantes.—The little threads and spots which, by some persons, are seen to float and glide over their field of vision, were formerly attributed very commonly to congestion of the choroid. Tyrrell, for instance, assigned as their cause 'a preternatural dilatation of some of the delicate vessels' of the part. It seems strange that any one could overlook the fact that *fixed* bodies—which dilated vessels of the choroid must be—if they pressed upon the retina so as to impair its function, would suggest to the patient the idea of *fixed* spots in the field of vision, which could only appear to move when the eyeball itself was set in motion. The spots known as *muscæ volitantes*, on the contrary, change their position whenever the eye is suddenly moved; and when the eye is again fixed, the spots still continue for a time to float about in various directions, eventually appearing to descend, as if sinking in a fluid.

They are most commonly met with in short-sighted subjects, and are quite compatible with life-long continuance of the acute powers of vision which such persons frequently enjoy. They are usually first noticed between the ages of twenty and thirty; and when they have begun to attract the patient's attention, they appear rapidly to increase in number. This apparent increase is partly due to the fact that, by anxiously watching them, the patient soon acquires a habit of bringing fresh bodies into view.

If the eye be turned towards a clear sky or a bright cloud, and then kept steadily fixed, the spots appear to sink slowly downwards, just as filmy particles would sink in a liquid, which had been shaken and then allowed to rest. A sudden turn of the eye will again cause the little bodies to disperse for a moment, and when the eye is once more fixed, they slowly descend as before.

So long as the patient steadily concentrates his attention on any external object, the *muscæ* are not seen; but if he accidentally catches sight of one of them the whole field of vision at once becomes crowded with them.

The best way of examining the floating bodies is for the patient to look directly downwards upon the illuminated field of a microscope. They will then be recognised as beaded filaments, variously twisted and bent; sometimes appearing as loose knots of coiled-up fibres entangled together. When thus

grouped they have a greyish colour, but when a single fila
is examined, it is seen to be made up of highly-refrac
globules, varying in form and size. Sometimes a filament
be seen to bend, and again become nearly straight, or to
in such a manner as to present itself in a foreshortened
tion. This latter circumstance proves that the bodies
freely in a fluid, and are not situated, as some have supp
upon the surface of the cornea. This is still further prove
the fact that the blinking of the lids has no effect whatever
the position of the *muscæ* in the field of vision. If, whe
lids are closed, the eyes are turned towards a strong li
exposed to sunlight, for instance—the *muscæ* can still be
and their movements will be just as free as when they
observed with the eyes open.

Some interesting experiments were made on hims
Mackenzie,* to determine the seat of *muscæ volitantes*; b
most conclusive researches as to their nature are those by
who has satisfied himself that these disquieting spectres
fact, nothing more than the beaded filaments of the v
body itself. The normal network of these filaments, h
can be seen by any one who knows how to look for t
under certain conditions, I presume, of impressibility of
Those filaments which, from being tangled together in ir
masses, form such annoyances to the patient, would ap
be the filamentous network in a disintegrated state.

There are few phenomena which give rise to more al
patients' minds than *muscæ volitantes*. A vague notio
they are the forerunners of amaurosis or cataract is almo
versal; and even medical men are apt to confound these
muscæ with the moving cloudy shadows resulting from e
of blood or lymph within the vitreous humour, or with th
spots betokening that some limited portion of the reti
become insensible to light. A careful attention to the a
ances of the *muscæ volitantes*, as I have described the
enable the patient to convince himself of their real natur
the surgeon may console him with the assurance that, al
incurable, they are perfectly compatible with exceller
enduring sight.

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* First in the *Edinburgh Med. and Surg. Journal*, for 1865; and agai
Practical Treatise, &c. 1854, p. 951.

† *Entoptics, with its uses in Physiology and Medicine*, 1864, p. 93.

is to be hoped that medical men in general will speedily ve at this conviction; for it is lamentable to meet with nts who have gone through years of treatment, often of severest kind—even to bleeding and salivation—or at best gh an equally ineffectual course of tonics and local appli- ons, and after all have remained with their *muscæ* undi- ished, and their minds still burdened with anxiety and fears pproaching blindness.

Appearances so common as floating *muscæ* will of course be erved by multitudes of persons who subsequently may become subjects of either retinal disease or cataract. All I mean insist upon is, that the *muscæ* and the diseases of retina or have no causal relation to each other.

CHAPTER IX.

DISEASES OF THE LENS AND CAPSULE.

a state of health the lens and the membranous capsule en- losing it are perfectly transparent. In early life they are also ite colourless; but after the age of thirty the lens in most persons begins to assume a pale-yellow tinge; and this gradually becomes more marked as age advances, until in old subjects it frequently acquires the colour of amber.

Any loss of transparency in the lens, whether affecting the whole or only a portion of it, constitutes *cataract*; and in strictness this term should be limited to changes in the lens and its capsule. To call an opaque inflammatory effusion in the area of the pupil a 'spurious cataract,' is to introduce a loose and uncertain terminology, which can only give rise to confusion in our descriptions of disease.

Abnormal position of the lens.—The 'suspensory ligament,' which is attached to the capsule all round the margin of the lens, maintains it in a fixed position. A blow on the eye sometimes ruptures a portion of this ligament, and allows the lens to become tilted backwards. If the ligament is detached to a considerable extent, the lens sways to and fro with every movement of the globe, and vision is much confused. Eventually, under such conditions, the lens becomes opaque; but I have seen cases in which it remained transparent for a very considerable time.

It appears that the suspensory ligament is liable to a congenital defect, whereby the lens, instead of maintaining its normal position, undergoes displacement in a lateral direction, so that its centre no longer coincides with the centre of the pupil. A curious instance of this malposition of the lens occurred in a mother and three children who came under my care. In the mother, and in one of the sons, both lenses were displaced upwards and inwards; in another son, directly inwards; and in the third, directly upwards. In none of these cases did the lenses deviate, or only in the slightest possible degree, from their normal transparency.*

CATARACT.

This term, as I have already observed, should be strictly limited to denote partial or complete opacity of the lens.

The existence of capsular cataract has of late years been called in question, and I shall presently notice the grounds of this new opinion.

Opacities of the lens do not appear to be all of precisely the same nature. Some depend upon a shrinking and wasting of the fibres themselves, without any appreciable change in their chemical composition, while the more strongly-marked and chalky-looking streaks and spots are formed by new deposits of earthy and fatty material.

We shall best appreciate the changes which take place in cataract by glancing at the anatomy of the lens. It is completely enclosed within the very thin, but strong, capsule, which is throughout perfectly transparent and homogeneous. To this capsule is attached the 'suspensory ligament of the lens,' which passes off from the back of the ciliary processes to be implanted into the capsule of the lens, with which it becomes identified. Immediately within the capsule is a layer of cells; internally to this layer are arranged the superficial fibres of the lens, softer and of a more fragile consistence than those forming the centre or *nucleus*. The fibres of the lens are disposed in planes, the exact arrangement of which cannot easily be understood without the aid of diagrams; it may suffice for our purpose, however, to state, in general terms, that the fibres form radii ıg from the circumference to the centre, and are more ı they are nearer to the anterior and posterior surfaces ns, and less curved as they approach its vertical plane. ›eing the manner in which the elements of the lens ıged, we shall at once perceive the reason why the of cataract present such different appearances, accordhey are in the superficial cellular, or the deeper fibrous

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* See a description of these cases in *Ophthalmic Hospital Reports*, vol. i p. 54, 1858: also in my *Guide to the Practical Study of Diseases of the Eye*, 2nd edit. p. 401.

the superficial cells and adjacent soft fibres of the ›me disintegrated and broken up, and intermixed with diffused earthy deposits, the whole area of the pupil a milky appearance, without any regular striæ being If the softening process has been going on for a long re is usually an abundant formation of fatty matter, aintly-bluish skim-milk colour gives place to a slightly nt, like that of cream.

vever, the cataractous opacity commences in the unbres of the lens forming its cortical portion, whitish ıre seen converging from the circumference towards the In persons past middle life some of these streaks have y-yellow cast, while others are perfectly white. This of tint depends upon the fact I have already noticed, that the body of the lens, after the age of thirty or ıuires a yellow tinge; and consequently, although the treaks are in themselves white, only those appear so e on the anterior face of the lens, and are viewed the colourless media of the cornea and aqueous humour; the contrary, the streaks on the posterior face of the ıg seen through its still transparent, although yellow-, acquire a corresponding change of colour. A pracwill also recognise a difference of form between these of striæ; those on the front of the lens presenting a , and those on the hinder face a concavity, towards of the iris.

striæ can be clearly seen only in the earlier stages of for eventually the superficial fibres and cells become ıp and disintegrated, and then the lens presents one whitish or greyish surface.

›res of which the *nucleus* consists are denser and firmer se constituting the cortical portion; but they are disthe same radiating form. When this nucleus becomes n old age, it does not present the marked striæ so characteristic of *cortical* cataract, but assumes a more unifor cloudy appearance. The distinction between the *cortical* the *nuclear* portions of the lens are best seen in the common f of congenital cataract, in which the whole nucleus is opa while the periphery remains almost or quite transparent.

I have briefly alluded to the doubts which some histolog have thrown upon the existence of 'capsular cataract'—a te employed even quite recently as designating one of the t grand divisions of cataractous opacities. These doubts chi originated with Stellwag,* who, after carefully examining wi the microscope about fifty cataracts with apparently opaq capsules, asserted that in every instance the opacity was cau by substances *attached to* the lenticular surface of the capsul but not *deposited in* the very tissue of the capsules themselv The opaque material which, to the naked eye, seemed identifi with their tissue, chiefly consisted of earthy and fatty deposit firmly adherent to it, but yet separable by mechanical or chemic means.

The marbled and mottled appearance commonly described characterising 'capsulo-lenticular cataract' is said by Stellw to depend upon the irregular manner in which the eart and fatty material is deposited on the inner surface of t capsule.

Although the facts pointed out by Stellwag and others m justify us in discarding the term 'capsular' as designating species of cataract, it would be affectedly precise to aband the term *opaque* as applied to a portion of capsule impedi vision, merely because the opacity may be due to earthy or fa matter adhering to the membrane. And, indeed, a portion capsule which is transparent and invisible when perfec tense, will become opaque when relaxed and thrown into fol

Reverting to the changes in the lens itself, I would obse that a very common error exists with regard to the use of terms *hard* and *soft* as applied to cataract. These terms employed as if, in certain cases a softening process set in fr the very first, whilst in other cases the reverse took place, the whole lens underwent a steady process of hardening. if we examine a healthy lens at the infant period of life, compare it with one which is congenitally opaque, we sh find but little difference in the consistency of the two structu the adult, the lens retains nearly its normal consistency so as the opacity remains at the striated stage, and it is not after a considerable period that the superficial portion of lens undergoes that process of disintegration which imparts it the uniformly whitish and milky appearance.

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* *Die Ophthalmologie*, 1853–58.

Again, in old subjects the commencement of cataract is not nded with any marked hardening of the lens, although, as nucleus becomes opaque, its fibres appear to undergo a tain process of drying and atrophy. But even in the oldest sons superficial softening eventually sets in, usually many ars after the first commencement of opaque striæ.

Hence it will appear that the terms *hard* and *soft* express only certain stage in the progress of a cataract; that in no form the disease does the lens from the very beginning undergo gressive hardening; but those lenses which for a long time ain their normal firmness while opacity is advancing, ntually become softened, and may even, in the lapse of many years, undergo a complete transformation into a fluid condition.

Under the two heads, *Nuclear* and *Cortical*, we may arrange ll the various forms of cataract; abolishing the old term capsular cataract,' and assigning those opacities which were formerly known by that name to the *cortical* division.

Nuclear cataract would comprise, first, the congenital form of the disease; and, secondly, that which is met with in old age, either alone, or, more frequently, associated with marginal striæ.

Cortical cataract is by far the more usual form; for the opacity which occurs in middle life almost invariably commences in the cortical portion of the lens; and even in old age this is the rule, the rare exception being that the nucleus becomes cloudy before marginal striæ are developed.

It was owing to insufficient exploration of the eye that the reverse of this was formerly believed to be the case; but no one can have had extensive opportunities of examining the eyes of old persons under the influence of atropine, without convincing himself that, even in extreme old age, it is much more common to find marginal opacity beginning whilst the nucleus is still clear, than to find nuclear opacity beginning while the margin of the lens is transparent.

Diagnosis of cataract.—There is no better test of an ophthalmic surgeon's skill than his ability to determine the presence or absence of opacity in the lens. And nothing is more important to be precisely ascertained; for the want of skill to dete cataract in an early stage may lead the surgeon to regard th case as one of retinal defect; or, on the other hand, he m mistake the reflex of light from the retina for the opacity o cataract.

I will not detain the reader with a long account of th *subjective* symptoms which attend cataract; for the detection the disease depends wholly upon a careful examination of pa lying open to our observation. A full detail of subjecti symptoms is, no doubt, very useful in ascertaining the mor condition of a structure wholly concealed from our view; b this is not the case with the lens, and if we suspect opacity t exist, we have simply to look for it.

A more or less marked dimness of sight, uniformly involvin the field of vision—coming on gradually, and without inflam- mation, unattended with any impairment of motory power i the iris—such would be the symptoms which would make u suspect the existence of cataract. Our examination should be conducted in the following way:

The patient should be placed close to a window admitting bright daylight—not direct sunlight—and care should be taken that the light does not fall upon the cornea from more than one window, and that reflections from mirrors and other polished surfaces do not interfere with the single ray which should pass into the pupil. A convex glass of an inch focus should be used as a condenser, to concentrate light upon the surface of the patient's lens, while we explore it with the naked eye. In this manner faint streaks of opacity may be detected, which would otherwise escape us. Each eye must be separately examined.

We must never rest satisfied with a patient's assurance that he can or cannot read, but must obtain a precise standard of his sight by making him read aloud from type of different sizes.

In hospital practice, those who have not learnt their letters may be told to count dots, point out a single and a double line, an asterisk, and other typographical marks.

All these experiments must be made while the eye is in its natural state. We next proceed to dilate the pupil with atropine. A solution of two grains to the ounce of distilled water is usually strong enough for this purpose, and care should be taken to obtain the sulphate perfectly neutral. Any excess of acid makes the application painful, and so of course does of the lower lid, without the patient being aware that n application has been made.

n the pupil is fully dilated, we repeat our examination e, with the aid of concentrated daylight, carefully ting and exploring the extreme margin of the lens, and, dy be sufficiently transparent, lighting up and examinosterior surface. In this manner the faintest streaks nencing cataract may usually be detected; while dense along the margin of the lens, opaque striæ converging s anterior or posterior surface, delicate lines radiating e centre, or the uniform haze of a cloudy nucleus, can scape detection.

e cataract is still in a very early stage of development, it portant to ascertain the condition of the retina and that in every case the ophthalmoscope should be used lete our diagnosis.

amining the deep tissues we sometimes detect in them conditions, which would induce us eventually, when had become complete, to abstain from operating; or, eration were deemed desirable, it would be undertaken full understanding that only partial success would be le.

ning *à priori*, we should imagine that the ophthalmoould be an infallible means of detecting those faint f cataractous opacity which elude the ordinary modes of

Sometimes the very earliest commencement of cataract m be detected by examining the lens with the naked eye in darkened room, while a strong light is thrown upon the p either from the ophthalmoscopic mirror, or by means of a con glass of a short focus. This oblique illumination will of reveal highly-refractive globules and radiating lines through the whole extent of a lens, which to ordinary ophthalmoscop examination seemed transparent.

I have already spoken of the twofold division of cataractu opacities into cortical and nuclear, accordingly as they a situated in the periphery or the centre of the lens. To give s special names to cataracts, in consequence of the various sha which the opaque deposits assume, appears to be altogeth trifling and useless. It is evident that the transparent a opaque elements of a diseased lens may arrange themselves i such a manner as to produce infinite variations of shades a figures, without offering any real variety in their compositio There are, however, a few leading peculiarities connected with age and mode of development, which demand a separate notice.

CONGENITAL CATARACT.

This opacity may exist in very different degrees.

1. The slightest form is that of a small white central dot o the anterior face of the lens (*Cataracta centralis*). This dot con sists of a minute portion of earthy matter deposited in the mos superficial portion of the lens, just within the capsule. In case of this kind the rest of the lens commonly remains throughou life transparent, and the patient is often unconscious of an defect of vision. Occasionally, however, a few faint whit lines are seen radiating from the central dot. If the rest of th lens remains transparent, this slight form of cataract should b no means be treated by operation.

2. Sometimes, instead of forming a minute central dot, th earthy deposit is so large as to occupy nearly the whole area o the pupil, when in its contracted state. The deposit projec forwards in the shape of an obtuse white cone, and appears adhere by its base to the anterior surface of the capsule. Th however, is not really the case, the cretaceous mass being e bedded in the superficial portion of the lens, and covered by t transparent capsule. The term *Cataracta pyramidata* has be given to this congenital form.

.verge to an opaque white patch at the centre of the
en the pupil is widely dilated with atropine, this
seen to be surrounded by a perfectly black area, and
his clear ring-shaped space the patient has tolerably
n. Those who examine such cases for the first time
o imagine that the opaque nucleus which they see
stitutes the whole lens, shrunken and contracted to an
ly small size, and that the dark ring-shaped space is
unoccupied by lens-tissue. Occasionally a few white
seen to traverse this space, passing from the opaque
the outer margin of the lens. When such a nuclear
is broken up with the needle, in the operation for
he real nature of the case is made manifest, and the
l portion of the lens soon becomes as opaque as the
self.

of this kind are not operated upon in early life, the
lthough very short-sighted, continue for many years
onsiderable powers of vision; but usually, towards the
rty, if not sooner, the peripheral portion of the lens
a change, and gradually becomes opaque.

rm of congenital cataract, much more rare than that
ibed, consists of a very faintly-striated opacity of the
unaccompanied by that chalky-white central patch
ders the ordinary congenital cataract so conspicuous
sy of diagnosis. Several instances have come under

became at first short-sighted, and then gradually lost th of reading any but large type, or of recognising faces a room.

I have observed two distinct forms of opacity i cases.

In one form the lens was dotted throughout with white points, arranged in the course of its fibres. Th were as small as if pricked-in with the finest needle, general effect they produced was that of a very faint ha the pupil, only recognisable under concentrated light.

In a second set of cases the opacity was wholly co the posterior surface of the lens. In some instances t one isolated patch in that situation, not exactly in the a lens, but reaching from near that point to its extreme e other cases the whole posterior face was covered with opaque lines, closely set together, and converging circumference to the centre, so as to produce the ef delicate fibrous membrane of concave form. Encircling centre of this opaque surface was a whitish ring, mo and earthy in appearance than the rest of the striate of which it formed a part.

These opacities, limited to the posterior face of th course require for their detection far more careful ob than congenital cataract of the ordinary kind, in w whole nucleus is opaque, and the centre probably mark chalky-white patch in the very centre of the pupil.

Congenital cataract, whatever form it may assum quently accompanied by a rhythmical twitching mov the eyeballs, the effect of irregular action either of th the oblique muscles. This twitching is known by the *nystagmus.* It does not, however, invariably accom genital cataract, some patients suffering from this affec entirely free from any irregular muscular action: whi other hand, *nystagmus* is met with in many cases of sight wholly unattended by any opacity of the lens.

There are certain morbid deposits in the deep tiss eyeball which in infants and children may be mistak opacity of cataract. Scrofulous and encephaloid de instance, in their early stage, are not unfrequently m this manner; but a careful examination through a w pupil, cannot fail to detect the real nature of the dise scrofulous and encephaloid deposits have a more or l icity is regularly striated, and perhaps exhibits also at e a white dot. In advanced scrofulous and encephaloid n the contrary, the anterior chamber is obliterated, the irregular, dilated, and fixed; the lens has an uniformly ppearance, and sometimes receives from the mass t a somewhat yellowish tint. Congenital cataract, too, variably affects both eyes; while encephaloid deposit s invariably occurs in one eye only. Scrofulous deposit leed, occasionally affect both, but rarely to the same r at the same time.

ldren and also in older persons who have been brought y notice for congenital cataract, I have been struck frequent occurrence of diseased teeth; the incisors and being dwarfed, deficient in enamel, discoloured and mbed on their anterior surface, and their cutting edge ay and blunt. I am unable to offer any explanation of lition of the teeth, which I do not find mentioned by halmic observer.

CATARACT IN ADULTS.

t as a result of injury, cataract is rarely seen to com- etween puberty and the middle period of life. Up to the rty it is a rare disease, it becomes more common in who have passed their fortieth year, but it is after the

arranged. After the age of sixty a hazy condition of
nucleus is commonly found co-existing with advanced margi
opacity; but even in extreme old age it is far more common,
I have already observed, for cataract to commence at the marg
than at the nucleus.

If we trace the rise and progress of cataract in an elde
person, the changes will usually be found to occur in
following order. First, opaque striæ are formed at the extre
edge of the lens, and commonly it is the lower edge which
thus affected. These striæ gradually coalesce into patches,
then spread themselves over the posterior face of the lens,
a few extending a short distance over the anterior face. At
point of development the cataract may remain stationary for
year, or even for several years. Then a farther change tak
place, and the whole body of the lens, but especially the nucle
becomes slightly hazy, but not so as to prevent the posterio
radiated opacity from being recognised when properly illumi
nated. The opaque striæ on the anterior face of the lens graduall
advance until their tips appear within the area of the pupi
The haziness of the body of the lens increases until even concen
trated light fails to reveal the posterior striæ, and at last onl
the anterior surface of the lens can be seen. At this stage
cataract, vision is restricted to mere perception of direct ligh
or of that reflected from white or polished surfaces. Perhap
bright colours may still be recognised.

Up to this point the fibrous structure of the lens can still
traced; but as years go on, its surface becomes more opaque a
whiter, in consequence of disintegration of the superficial fibre
and the deposit among them of earthy and fatty materi
Occasionally crystals of cholesterine, just within the capsule, m
be recognised by their peculiar sparkling appearance.

It sometimes happens that this final stage of superficial softe
ing does not occur, and the cataract is then very difficult
detection, having a dull brownish appearance like horn.

A very rare form of lenticular opacity is that termed 'bla
cataract.' The name is frequently given to lenses which a
only of a dark-brown colour, but absolute blackness is sometim
met with. It must not, however, be supposed that in the
cases the blackness of the pupil is like that presented by
healthy eye, in which all the humours are perfectly clear.
the two or three cases of black cataract which I have seen, the
was not the slightest doubt as to the existence of a catara

ough the blackness, so remarkable after extraction, was not pected; for, in each instance, several fine whitish lines could seen radiating on the anterior surface of the lens, formed, doubt, by slight earthy deposits just within the capsule.

Fluid cataract; Morgagnian cataract.—The softening process, ich begins in the superficial portion of an opaque lens, may on until, in the course of years, the whole mass becomes verted into a thin pulp. The nucleus, for a long time, ists this softening change, and a lens consisting of a firm leus, surrounded by a turbid pulp of disintegrated tissue, received the name of 'Morgagnian cataract.'*

As in fluid cataract all the superficial portion of the lens is integrated, there is of course no trace of those radiating so characteristic of ordinary opacity. Sometimes a fluid aract is bluish-white, like milk-and-water; in other cases it mes a dirty-grey colour, or a pale-yellow tint, like that of m. Its consistence appears unequal, as if some portions e coagulated, and others perfectly fluid.

The creamy colour is usually found in cataracts that have isted in the fluid state for a considerable time, and it seems ther paradoxical to assert that it is very difficult, even for a actised observer, to distinguish between a fluid lens of this ind and one which has undergone a change of a directly opposite character, and become solidified by earthy deposit. The perfectly fluid and the perfectly solid lens are equally devoid of fibrous markings, and the inequality of consistence in the former presents an appearance very similar to that resulting in the latter from the variety in tint, caused by the manner in which the earthy constituents of the solidified lens are deposit on the capsule.

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* This form of cataract was not described by the Italian anatomist from whose name the term is derived. In dissecting the eyes of animals he had observed a fluid to exude from between the capsule and the lens, and concluded that this fluid always existed during life. In compliment to the discoverer it was termed by anatomists *liquor Morgagni*, and its existence in the living eye was for a long time regarded as indisputable; subsequent observation, however, has proved it to be a product of *post-mortem* decomposition. Morgagni has been, as it were, quoted against himself; for, in treating of the causes of cataract, he suggests that the disease may originate in a deficiency of this very fluid, whereby the lens, he thinks, would become dry and opaque. His words are: 'Tunicâ in vitulis etiam, bobusque, sive recens sive non ita recens, perforatâ, pluries animadverti illico humorem quendam aqueum prodire: quod et in homine observare visus sum, atque adeo credidi *hujus humoris secretione prohibitâ*, crystallinum siccum et opacum fieri, fere ut in extracto exsiccatoque crystallino contingit.' (*Adversaria Anatomica*, &c., Lugd. Bat. 1741, Adv. vi. p. 90.)

The following are mentioned among the distinguishing sig of a fluid cataract—an advance of the iris towards the corn caused by an increase in the bulk of the lens, attending t fluid change—and a difference in the degree of opacity in t cataract, as respects its upper and lower portions, caused b the gravitation of its denser particles. But neither of the signs can be relied upon; for in cases of fluid cataract it oft happens that the iris deviates little, if at all, from a vertic plane; and the separation of the contents of the capsule into fl and solid is seldom sufficiently complete to allow of the mo solid portions gravitating in the manner described by authors.

If a fluid cataract is examined with the microscope, the le fibres are found in every stage of disintegration, mixed up wit earthy matter and a multitude of oil-globules.

TRAUMATIC CATARACT.

The lens may lose its transparency in consequence of a blo on the eye, although the globe may not be ruptured, or the le itself displaced from its connections; the mere shock bein sometimes sufficient to affect the nutrition of the lens, an induce a gradual opacity of its whole substance.

Any penetrating wound of the lens is sure to produce cataract and if the wound in the capsule remains open, so as to allow th superficial cells and fibres of the lens to imbibe the aqueou humour, the whole mass gradually becomes disintegrated and absorbed, so that eventually a wounded lens may wholly disappear without any surgical interference. It was a knowledge of this natural process that first suggested the operation for the cure of cataract by *solution*. It is only in exceptional cases that the whole lens becomes absorbed in consequence of a wound. More commonly it happens that a certain portion of lens-tissue remains enclosed within the capsule, and undergoes fatty change. The following is the appearance such a traumatic cataract would present some years after the occurrence of the injury.

There is probably some adhesion of the pupillary margin to the capsule, the result of old iritis; the pupil is occupied by a disk, formed by the approximation of the anterior and posterior surfaces of the capsule, enclosing between them some remains of very opaque lens-tissue. This disk is situated much r back than the position occupied by a full-sized lens, and ad-white patchy area not unfrequently exhibits some ning crystals of cholesterine.

cases where the wound of the lens has been followed by a lerable amount of iritis, the whole margin of the pupil e found adherent to the anterior capsule, which may also ated with a dense membrane, composed of old lymph. upillary area may be small, and not susceptible of increase use of atropine, on account of the intimate union between ris and the capsule. Occasionally there is a deceptive rance of a partial opening of the pupil, and a casual or erienced observer will suppose that a sufficient portion of upil is free, so as to allow of useful vision. The supposed ure, however, is really a patch of black pigment, lying on hitish membrane which is closing up the pupil. Light, ntrated on the part by means of a lens, will almost always l the true nature of the supposed aperture, or, should this s fail, the ophthalmoscope will at once resolve the doubt. would be impossible to describe all the various appearances nted by the pupil after the partial or complete absorption rounded lens. The capsule may block up the entire space manner just described; it may form a delicate filmy net- hardly visible except under concentrated light; it may been completely torn through at its centre, the peripheral n retracting all round, so as to form a white ring, almost n by the iris; or it may assume the appearance of a single band stretched across the pupil from side to side. In , there is hardly any possible variety of figure which the e capsule may not assume.

never undergoes absorption, but it often appears to do so, nsequence of the manner in which it retracts and shrinks her when divided. This retractile property of the capsule d always be borne in mind by the surgeon, in the various ate operations which become necessary when an opaque on of it is obstructing the pupil. He should take care not late any part of the opaque membrane, but to regulate his ons and lacerations of it in such a manner that it may s have a fixed point at the periphery, towards which it retract, and so leave the central portion of the pupil free.

slocation of the lens into the anterior chamber.—This accident place as a result of external violence, such as a blow upon yeball or a violent fall. It more frequently happens when the lens has been long in an opaque condition, and its suspensory ligament weakened, or partially detached by disease. The appearance of an opaque lens in the anterior chamber is so peculiar, that the nature of the accident can hardly be mistaken. When the lens is dislocated in a transparent state, its margin presents the appearance of a ring of golden light. Pain and inflammation set in very soon after the occurrence of the accident, and loss of the eye can be averted only by prompt removal of the lens, through a suitable opening in the cornea.

I have already spoken of certain forms of partial displacement of the lens, when treating of the inflammation such accidents give rise to (see the section, 'Traumatic Iritis,' p. 98); and have considered 'subconjunctival dislocation of the lens' in the chapter on Affections of the Sclerotic (p. 90).

TREATMENT OF CATARACT.

Before describing the treatment of cataract, I may be expected to say something respecting the morbid agencies which give origin to it. But, in truth, the causes of cataract, whether remote or proximate, have hitherto received no satisfactory explanation. The fact that the lens may be opaque at birth or may become so in old age, at once proves under what widely different conditions the disease is developed; and we need but cast a glance at the varying and even opposite theories which have been given as to the predisposing causes of cataract, to convince ourselves they are but guesses, for the most part fanciful and unfounded.

Thus, one author thinks that persons exposed to the heat and glare of strong fires are predisposed to cataract; another makes the same remark of those who drink sour wines; by a third, the prevalence of cataract among the Turks is attributed to their using opium; while other observers consider that the inhabitants of volcanic countries are peculiarly liable to the disease. Certainly, in its senile form, cataract is common enough among our own agricultural labourers, who know nothing of sour wine, and very little of opium, are not incommoded by over-large fires, and never saw a volcano.

The truth seems to be, that, in all countries, cataract is a frequent accompaniment of advancing years; and neither social position nor peculiarity of employment exempts the aged from being liable to it.

cataract be cured without an operation? This question answered in the affirmative by hosts of quacks, who, for wn selfish ends, avail themselves of that shrinking from ng bearing the name of an operation, which is a natural :t in us all, and pretend, by means of liniments, or drops, still more scientific-looking galvanic battery, to turn e lenses into clear ones.

would be presumptuous and absurd to pronounce abso- that no cure for cataract, short of a surgical operation, er become possible. But certainly nothing approaching h a cure has hitherto been discovered.

surgeon must constantly be on his guard against being ich impressed with the mere existence of opacity in the s if it were altogether an independent disease.

ious inflammatory conditions of the eyeball may eventually e cataract, but in such cases there are usually some signs ase in other tissues, as well as certain peculiarities in the n or appearance of the lens itself. Old adhesions between pillary margin and the anterior capsule—a bulging for- gainst the cornea of the iris and lens, or their receding backwards, so as to produce an unnaturally large anterior er—an irregularly dilated and fixed pupil—a tremulous- f the lens whenever the recti muscles are put in action— oss of perception of light—such are the more striking ions which at once would lead us to institute searching ies into the earlier history of the case, or to regard the ct as unsuited for operation.

ust always be remembered that simple opacity of the lens, er far advanced, never deprives a patient of perception of provided the retina is sound. Indeed, in the great majority tances, a patient with no other disease in the eye but an e lens, will not only readily perceive the shadow of a hand, er object, passing between him and the sky, but, with his to the window, will perceive the light reflected from a of paper, although he may be quite unable to detect the of the reflecting surface. Many patients, with densely e lenses, will, in the same position, recognise well-illumi- coloured surfaces, such as bright red or yellow, or will iscriminate between yellow and white. If, in addition to rceptive power, the iris maintains its vertical plane, the s round and active, the cornea brilliant, the consistency and movements of the globe perfect, the surgeon may regard the cataract as suitable for operative treatment.

Long experience and observation will give to the surgeon a certain empirical tact in determining whether a given case of cataract is, or is not, fitted for operation. He recognises at once the difference between an eye which has passed through inflammatory stages, and one in which simple opacity of the lens is present. In the latter case, however dense the cataract may be, the patient has a certain expression of *trying to see*, quite different from the manner of one who merely turns his eyes this way or that, at the command of the surgeon.

In all cases the pupil should be dilated with atropine before the surgeon finally resolves to operate, so that no concealed adhesion between the iris and the capsule may remain undetected.

OPERATIONS FOR CATARACT.

These may be arranged under three heads: *depression*, *solution*, and *extraction*.

1. In *depression*, or 'couching,' as it was formerly termed, the lens is thrust from its natural position in such a manner that, although still within the eye, it may allow the rays of light to pass unimpeded through the pupil to the retina.

2. The operation by *solution* or *absorption* grew out of that by depression; for it was found that if, in the attempt to depress the lens, it accidentally became much broken up, the fragments gradually dissolved and disappeared; and hence it occurred to certain thoughtful observers that this absorbent power in the system might be taken advantage of in such a manner as to avoid the dangers inseparable from the old operation of 'couching.' Hence arose *discission* or *division* of the lens, since modified into the operation by 'solution.'

3. In *extraction* the opaque lens is removed bodily out of the eye, through a wound made for that purpose in the cornea.

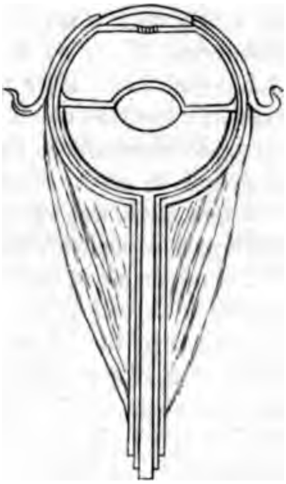
OPERATIONS BY DISPLACEMENT OF THE LENS.

(*Depression*; *Reclination*.)

Those who are interested in the early history of ophthalmic surgery will find the older descriptions of cataract, and the operation for its cure, wholly unintelligible, unless they are ed with the views of the ancients respecting the ' of the eye.

so late as the time of Vesalius it was believed that the apied the exact centre of the nd it is so figured in that st's work, *De Corporis Humani* 1555, p. 798, where it is xactly midway between the the junction of the optic th the retina; the posterior of the aqueous humour and nber of the vitreous humour ecisely of the same extent. position of the parts would e afford ample space for an *umour* to collect, and form osed 'cataract' between the the iris.

FIG. 146.



Section of the eye as figured by Vesalius.

curious fact that, while the of 'couching,' or depres- l been practised from very ies, each successive genera- rgeons firmly maintained that what they depressed was ens—which, indeed, they believed to be the immediate ision—but a skin, or coagulated film, in front of it. Paré, the most celebrated surgeon of his day, after g the mode of introducing the needle through the and depressing the cataract, adds, 'en faisant telie faut bien donner garde de toucher à l'humeur cristalin, ie, comme nous avons dit, il est le principal instrument e.' *

not until the latter part of the seventeenth century real nature of cataract was understood; and some of culists, who had passed their lives in depressing lenses mowing it, were furious at the new-fangled theory of being the opaque lens itself.†

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thode curative des Playes, &c. Paris, 1561.

Voolhouse, an oculist who, in spite of his gross ignorance, was the rator of his day, was most indignant when Brisseau, appealing, his assertion, to dissections of cataractous eyes, declared the lens seat of cataract. Facts were against Woolhouse;—'tant pis pour

The early surgeons, therefore, who, from time immemori had taught the operation of depression, however they may h erred in *practice*, through their ignorance of the real pathol of cataract, acted in perfect accordance with their own *theory* its nature; for such a membrane as they believed a cataract be, when once thrust fairly away from the pupil, would have been likely to set up irritation. One can less read understand how, after the real nature of cataract had bee known, operators could still imitate the old manipulations, persuade themselves that so bulky a body as the lens coul displaced in such a manner that it should not press upon interfere with, any of the delicate tissues surrounding it.

To pass a needle through the sclerotic, until its point arr at the upper edge, or the front surface of the opaque lens, wh was then thrust downwards, or backwards and downwards, embedded in the vitreous humour, appeared a real trium surgical skill; so instantaneous was the benefit conferre the operation, and so trifling the pain of its performance. patient was in a moment restored to sight, and the smallne the wound seemed to obviate all risk of inflammation. no doubt, depression, or the modified form of it, termed rec tion, in which the lens is turned over on its posterior instead of being thrust vertically downwards, would be a perfect operation, if it were possible to insure the lens l conducted to the position so neatly figured in diagrams, it reposes in the vitreous humour, quite out of the way o pupil, and close to, but never touching, the retina or c processes.

But how is the lens to be so placed in reality? Even whole eyeball were as transparent as the cornea, so tha surgeon could keep the point of his needle in view throu every stage of the operation, how could he deposit the precisely in the position I have mentioned? Or, if he succ in leaving it in the very spot he had intended, below the and yet above the retina, how could he insure its rema there? how prevent its sinking downwards, so as to co contact with the retina, or falling forwards against the c processes and iris, where it must act as a foreign body, a up irritation which nothing could subdue?

Depression, the oldest form of operation by displacemen performed in the following manner. The patient was s and the surgeon sat facing him. An assistant, standing b ent, steadied the head and raised the upper lid. The being thrust through the sclerotic, a little below the of the eye, and a short distance from the edge of the was to be carried between the iris and lens, until the the instrument appeared in the area of the pupil. It ust on as far as the upper part of the lens, which was essed directly downwards, until it descended below the level of the pupil. It must be evident to any one with the anatomy of the eye, that a body so large as the ld not be made to descend vertically to any considerable without coming in contact with the ciliary processes; must remember that the old oculists performed their ns without the aid of mydriatics, so that they could e cataract out of sight without forcing it to descend as would be necessary to make it disappear from an lly-dilated pupil. Still, there can be no doubt that equently thrust the opaque lens either against the rocesses or against the retina, and hence the 'inflam-' which was looked upon as almost a natural consequence peration.

viate the danger consequent upon depressing the lens downwards, the operation of *reclination* was devised, the lens was pressed in a direction backwards, down-nd a little outwards. The needle was passed on until its aped head appeared in the area of the pupil, as in the n of depression; but the flat of the instrument was placed anterior face of the lens, a little above its middle, and pressed against it, until the lens was forced to quit its position, and sink down into the vitreous humour. Here it e left, with its anterior surface directed upwards, its poste-face downwards; close to, but not touching, the retina; r edge towards, but not in contact with, the ciliary pro- a state of things often figured in diagrams, but rarely, I think, effected in practice.

close approximation of the pupillary margin to the anterior of the lens must render it almost impossible to pass an ent between the two structures without wounding either the other of them. In fact, the capsule is usually opened, dergoes still farther rupture in the attempt to dislodge s. No doubt this accidental rupture of the capsule and uld, in some degree, obviate the dangers of the operation, ch as a lens thus partially broken up would have some chance of undergoing absorption, which would not take place if the lens, according to the idea of the operation, were displaced still enclosed in its unbroken capsule.

If chronic change should have occurred in the suspensory ligament of the lens, the cataract enclosed in its unbroken capsule might sink at the first touch of the needle, especially if the vitreous humour had become unnaturally diffluent; but if no such changes should have taken place, the vitreous humour would offer great resistance to this reclination of the lens; and accordingly, various plans were suggested for facilitating the reclination by certain preliminary manœuvres. It was proposed, for instance, as soon as the needle had pierced the coats of the eyeball and entered the vitreous chamber, to carry the point to the back of the lens, for the purpose of lacerating the posterior capsule; then the point was to be carried round to the anterior capsule, which was to be lacerated in a similar manner, and it was not till after this preparation that the surgeon was to displace the lens itself.

Other operators, finding that the elasticity of the healthy vitreous humour was an obstacle to the passage of the lens through it, suggested that the needle should first be passed to the spot where the lens was finally to be lodged, and that a bed should there be prepared for it by the disintegration and breaking-up of the cells of the vitreous humour; and to this bed the lens was finally to be conducted by the needle applied to its anterior surface.

Descriptions of all these manœuvres read very well; but to carry them into effect is a very different matter. It must be remembered that while the point of the needle is lacerating the posterior capsule, or making a soft place in the vitreous to receive the lens, the instrument is wholly concealed from the surgeon's view, and is within a few lines of the most delicate and important structures. What risk must there not be that, while endeavouring to break up the cells of the vitreous, or lacerate the capsule of the lens, the surgeon may all the while be tearing up the ciliary processes, or even the retina itself!

To evade the difficulty of displacing a cataract by mere pressure with the flat of the needle, some operators proposed that, instead of carrying the instrument between the iris and the anterior capsule, its point should be thrust fairly into the substance of the lens, which would then be easily displaced, and carried downwards and outwards into the vitreous humour; the

disengaged by rotating it. Two difficulties, how-
;tend this operation—the risk of driving the lens
nstrument in the attempt at transfixion, and of
lens against the retina in endeavouring to disen-
nt of the needle.

supposing that the surgeon succeeds perfectly in
g the object he has proposed to himself, and, by
reclination, modified by any of the methods I have
s displaced the cataract from the axis of vision, and
e vitreous humour, without inflicting injury either
processes or the retina—what has he done? He
l a large foreign body—for as such we must regard
lens detached from its organic connections—in
ity to the retina. How can he insure the foreign
ining suspended in the vitreous humour, without
contact with surrounding parts? Will not the
in the immediate neighbourhood of the cataract
dual disintegration, and allow it to come into con-
retina, or fall forwards against the iris?

these would have been the almost invariable results
and reclination, were it not that, in the attempts
the lens, it very commonly became a good deal
nd this very accident it was which predisposed the
had been displaced, to undergo absorption. The
e, however, of most operations of displacement was
ad to justify my assertion, that it is essentially an
nd rough proceeding, calculated to set up a chronic
mmation in the deep tissues of the eye, which is in
re uncontrollable, inasmuch as the exciting cause,
lens itself, cannot be removed.

ced persons who witnessed an operation of displace-
pt to admire the rapidity and apparent ease with
performed, and the immediate restoration of sight
place; and they contrasted it, perhaps, with the
und made in extraction, the accidents that occasion-
that operation, and the slow after-progress towards
. But these appearances were deceptive; every by-
d see the difficulties and mishaps that attended
ut in depression or reclination, if only the cataract
rom the pupil, everything seemed to have succeeded.
inflicted on deep-seated parts could not be detected,
ly in following up the case that their result became

appreciated, in the slow and insidious changes within the glo which, many months after the operation, terminated in ut loss of sight. In such cases it was said how well the operati succeeded—how perfectly the patient saw, till, unfortunate inflammation set in, and, in spite of everything being done t medical skill could suggest, destroyed the sight. And why 'inflammation set in'? Either because structures essential vision had been injured by some stab in the dark during t operation, or because a foreign body had been left in cont with them, to set up in due time an uncontrollable process disorganisation.

OPERATION BY SOLUTION OR ABSORPTION.

I have said that this operation grew out of that by depressio and it is only surprising that some of the older surgeons, w had been struck by the manner in which fragments of the le accidentally detached during their attempts at depressio became spontaneously absorbed, did not discover that this la of absorption might be applied to the removal of the whol lens.*

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* Thus Pott, writing in 1775 on the subject of depression, says: 'When the opaque crystalline is in a state of dissolution, or the cataract is what is called perfectly soft, if the capsula of it be freely wounded by the couching-needle, the contents will immediately issue forth, and mixing with the aqueous humour will render it more or less turbid; sometimes so much so as to conceal the point of the needle and the iris of the eye from the operator. . . . The aqueous humour, however turbid it may become, will in a very short space of time be again perfectly clear; and if no disorder of the capsula of the crystalline, previous or consequential, prevents, the rays of light will pass without obstruction through the pupil, and the patient will be restored to as perfect vision as could have followed the most successful operation of either, or of any kind, in the same subject and under the same circumstances.' He adds: 'I have sometimes, when I have found the cataract to be of the mixed kind, not attempted depression, but have contented myself with a free laceration of the capsula; and having turned the needle round and round between my finger and thumb, within the body of the crystalline, have left all the parts in their natural situation; in which cases, I have hardly ever known them to fail of dissolving so entirely as not to leave the smallest vestige of a cataract.' (*Chirurgical Observations*, &c. 8vo. 1775.)

Pott's merit did not consist in being the first to observe that soft cataracts, if broken up, would wholly dissolve, but in turning an accident into a ground for a special and definite operation; thus establishing solution as a legitimate method of removing an opaque lens. Peter Kennedy, in his anonymous *Ophthalmographia*, 1713, relates how, having depressed a cataract in a woman aged twenty, he endeavoured a year later to do the same with the other cataract, which was of the 'curdly kind.' He adds: 'I had no sooner touched

n this law began to be understood, surgeons fell into the
e of supposing that the more completely the lens was
up at first, the quicker would absorption go on; and
erefore endeavoured to cut up the whole lens into frag-
by what was termed the operation of *discission*.

cure of cataract by solution is one of the most perfect
autiful within the range of surgery. It is based on the
ready alluded to, that if the capsule be lacerated so as to
the tissue of the lens itself to the macerating influence
aqueous humour, the cells and fibres of the lens, by
lly imbibing this fluid, become broken up and dissolved;
then so completely absorbed, that at the end of a period
in duration according to the consistence of the lens and
orbent power of the patient, every vestige of cataract will
isappeared. In fact, provided the patient's constitution
rous, and the lens be not too freely broken up at any one
is quite possible to effect the absorption of a cataract in
person, even up to the age of seventy. But, inasmuch as
h persons cataract usually advances simultaneously in
yes, the slow process of absorption is found to be weari-
nd inconvenient, and liable to be interrupted by slight
matory attacks; and as the operation requires to be fre-
y repeated, the more rapid cure by extraction is to be
ed.

leading principle to be observed in all operations for the
n of a cataract, is, not to oppress the eye with more broken-
s-tissue than the absorbing power of the organ is capable
idly removing. If this rule be neglected, the numerous
nts act as so many foreign bodies; inflammation is set

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the needle, when it broke, and mixed with the aqueous humour, which
g *drumly*, the patient could no longer see; I then withdrew the needle,
an to doubt of the success, but I found in a month's time all settled to
om, and her sight became clear and well.

imilar cures by solution had been quite unintentionally performed nearly
turies before the time of Kennedy; as the real seat of cataract,
r, was at that period unknown, these accidental cures by solution led to
er improvement.

e not seen quoted on this subject the following remarkable passage
mbroise Paré:—'Aucunes cataractes en les voulant abatre deviennent
lait ou eau trouble, à raison qu'elles ne sont encore assez dures; et que
se advienne encore y a il esperance de guarison, pour ce que puis apres
e peut rassembler, et apres quelque temps l'œil se clarifie, principale-
x jeunes.'—*La méthode curative des Playes*, &c. Paris, 1561, p. 239.

up in the iris and cornea, and then all absorption is at once arrested. The conjunctiva and sclerotic become injected; there is pain in and around the eyeball, with intolerance of light and lacrymation; the aqueous humour is turbid, and the epithelial surface of the cornea dull and uneven.

Operation on infants.—The breaking up of the lens, if carefully performed, is so devoid of danger that it should by no means be deferred on account of the tender age of the child; on the contrary, by operating early there is a greater probability of obviating those twitching movements of the globes (*nystagmus*), which so frequently attend congenital cataract. Of course, if the infant were extremely puny and ailing, affected with diarrhœa, or in any way weakened by temporary derangement of health, the operation should be deferred for a while, until the absorbent power had been restored; but it is desirable not to wait until the irritation of teething sets in.*

The needle I prefer for most of the operations on the lens has a small lance-shaped head, and the relative proportions of the head and the shaft of the instrument should be exactly such as will allow of the shaft playing with perfect freedom in the aperture which the head has made. If these proportions are not accurately preserved, and the shaft is made larger, with the view of preventing the escape of the aqueous humour, it becomes wedged in the wound, and all movements of the point are diffi cult and constrained. A needle of a larger size than that use for the ordinary operation on infants is very useful in breakin up the capsular obstructions which remain after the lens-tissu has become absorbed, as the head may be of such a size as t allow of its convex edges being made to cut.

All cataract operations are best performed on patients lyin down. It was, I believe, at the Moorfields Hospital that th position was first adopted for all such operations, and it ha the operator contents himself with using a single needle imself with the other hand use the forceps; but if he more complete laceration of the lens by the use of two t once, he must of course intrust the forceps to the a second assistant.

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* The merit of Saunders seems to have been limited to establishing *as a ru* that congenital cataract should be operated on in early infancy. No doul this rule is a most important one; but the extravagant praise on that accou claimed for Saunders by his partial friends strikes one, at this distance of tim as quite disproportionate; and his practice of keeping the operation a secre or at least of excluding medical men from witnessing it, would in the prese day be reprobated as illiberal. One pupil, Adams (afterwards Sir William was set apart, almost with the solemnity of a consecration, as the suffragan Saunders, but of course the operation very soon became the common proper of the profession.

ere I may observe, that the rule I have mentioned, as tant to bear in mind—namely, to avoid attempting too the first operation for solution, admits of an exception se of congenital cataract in *infants*. During the first ths of life the lens is so soft in texture—it so readily the aqueous humour, and undergoes dissolution, and rbent power is so active—that the lens may be freely in every direction without the same risk of iritis and lammation, as would attend a similar disintegration of older child or an adult. During the operation for solu- an infant I have frequently seen the entire lens shell s capsule, and slip forwards into the anterior chamber, any inflammation taking place, the lacerated lens undergoing complete absorption.

us to any needle-operations for cataract, the pupils e dilated with a few drops of solution of atropine, n hour or so before.

edle is to be introduced through the cornea * close to ion with the sclerotic, and carried on until its point he centre of the pupil. Then the anterior capsule is until its point reaches the middle of the pupil, before the second one is introduced through the cornea.

In an infant with congenital cataract both eyes may be operated upon at once; but in an adult the worse eye, if there be any difference, should be operated on first, so as to leave the patient one partially useful eye, while the process of solution, with the temporary loss of sight which it involves, is going on.

After the operation both eyes should be kept closed by means of a light bandage, or strips of plaster on the eyelids, for twenty-four hours, by which time the little wounds in the cornea will have closed.

If the lens has been effectually broken up, and the infant is in good health, a few weeks will sometimes suffice to insure the absorption of the entire cataract; and the capsule, gradually retracting towards the periphery, will ultimately form a white ring almost or altogether concealed by the iris when the pupil is contracted.

But it is not always possible to effect this complete dispersion of the cataract by a single operation, and the capsule, enclosing between its layers a certain amount of unabsorbed lens-tissue, remains as a chalky-white disk, blocking up the pupil and preventing all useful sight. In such cases the two needles must again be employed, and the central portion of the opaque membrane torn through to the desired extent; or, in some cases, it may even be necessary to introduce the cannula-forceps through an opening made in the cornea, and extract the capsule entire. This latter proceeding, however, should never be resorted to if a good central opening can be effected by means of the needles only; for in spite of every precaution, the pupillary edge frequently becomes adherent to the wound made for the introduction of the forceps; or else the traction of the iris, to which the capsule often adheres, causes subsequent distortion and deformity of the pupil.

Operation on children and adults.—The cataracts which com before us in children, and in persons under thirty years of age are very commonly those of the congenital form, which ha been overlooked during the period of infancy. For it is rare t meet with instances in which cataract *begins* to be develope in childhood, or in the early years of adult life. The operatio for the solution of cataracts of this kind is the same as that have just described on the infant, with this important exception—that in the older subjects we must take care not to se up irritation in the eye by too extensively breaking up the lens at first; least of all must we be indifferent to the risk attending the accidental displacement of the lens into the anterior chamber, an occurrence which, as I have said, may happen in the infant without any bad results.

In the first operation on an adult, the surgeon should not do more than freely break up the anterior capsule to an extent equal to the area of the pupil when not under the forced dilatation of atropine, and disintegrate the superficial portion of the lens, without disturbing the nucleus. This may be done with a single needle, the spring speculum being used or not, according to circumstances. When aided by a skilful assistant, the surgeon may often dispense with the speculum; but it is usually more convenient to employ it, and its use will enable the surgeon to perform the operation alone, if no assistant is at hand.

In using the needle, the surgeon is always to begin to act with the point upon the central portion of the lens; and in all subsequent operations he is to work from the centre, endeavouring to effect an opening in this situation quite through the lens and posterior capsule, leaving a ring-like portion of both, to be dealt with, if necessary, by a final operation with two needles.

If, instead of beginning to attack the lens at the centre, the surgeon uses the needle at random, and breaks up the lens at the circumference, he will probably set loose some portions of capsule, which will afterwards wave to and fro in the pupil, and be a most serious impediment to the final success of the case.

After the operation both eyes must be kept closed for twenty-four hours, at the end of which time the needle-wound is usually united, and the aqueous chamber refilled. From the second day it will only be necessary to close the operated eye, and after a few days a shade may be substituted, and then that may be laid aside for a pair of tinted glasses. The day after the operation atropine should be reapplied, and its use continued so long as any sclerotic zone remains, or so long as the swollen and macerated lens threatens to press upon the iris. Day by day the white flocculent lens-tissue continues to pass through the opening in the capsule; and if the pupil is not kept well dilated, so as to make room for the increasing bulk of the lens, the iris will become inflamed, and pain will be set up in the eye.

No absolute rule can be laid down as to how often and what intervals it will be necessary to repeat the needle-operati In exceptional cases I have known a single operation suffice the total absorption of the lens even in an adult: and in healthy infant, after completely breaking up the lenses, I ha seen both of them wholly absorbed at the end of two mont More commonly, it is necessary in children and young perso to repeat the disintegration of the lens a second time, at a interval of some months after the first operation, and a finishi touch with the needle may subsequently be required thoroughl to clear the pupil from capsule. It is important not to b premature in performing this final operation on the capsule, for during the process of absorption it undergoes so many change of position by shrinking, that time should be allowed for it to settle into its permanent position before the final laceration of it is made.

If, from peculiar circumstances, it be thought advisable to procure the solution of the lens in an elderly person, or in one whose power of absorption is very feeble—or in a case where the lens is of that peculiar waxy consistence which renders it so little disposed to imbibe the aqueous fluid, and become loosened up and flocculent, the surgeon must be prepared to use the needle more frequently; for, in these instances, solution proceeds at a very slow rate, only just the quantity of lens-tissue which is crumbled off at the time of the operation being absorbed, and then no advance being made until a fresh portion of the lens is dug out.

Under these conditions, it may be necessary to employ th needle every two months; and if slight attacks of inflammatio occur to interrupt the process of absorption, even longe intervals must be allowed, so that a twelvemonth or more ma elapse before a perfectly clear aperture through the centre the lens is obtained.

In an adult it sometimes happens that, either on account the lens having been too much broken up at once, or in consequence of the absorbing power having been checked by inflammation, the eye becomes oppressed by the displaced fragments lens; the sclerotic and conjunctiva then become injected, ther is intolerance of light and profuse lacrymation, the iris become discoloured, the aqueous humours turbid, the cornea hazy an uneven on its epithelial surface. When these symptoms se in, the eye will be lost by chronic inflammation, unless it b l to a healthy state, and that portion of the lens which n left *in situ* will steadily undergo complete solution.

a a perfectly *fluid cataract*, or one which has to a very xtent undergone the fluid change, is operated on with dle, it almost invariably happens that distressing nausea lent vomiting set in immediately; and in some cases I nown this state of sickness, attended with intense neu- to continue for twenty-four or thirty-six hours. As soon apsule is punctured with the needle, a puff of creamy kes place into the anterior chamber, and a farther escape fluid conceals the iris from view. If nothing farther is he distressing sickness is almost sure to set in; but if rgeon gently withdraws his needle, and immediately ces at the same spot a broad cutting-needle, or the f a cataract-knife, and rotates the blade, the whole of ky fluid is evacuated, and the sickness is wholly or to a xtent averted. The nausea is best combated by allowing ient frequently to swallow small fragments of ice; and ralgia in the ophthalmic division of the fifth nerve will ly yield to the application of chloroform liniment, applied ns of lint to the forehead and temple.

ations on opaque capsule.—It sometimes happens that, in g up a cataract with the needle, the anterior and pos- portions of the capsule are so effectually lacerated, that tract sufficiently to leave the area of the pupil unob-

OPERATIONS OF EXTRACTION.

The solution and absorption of a cataract in an old pe is an extremely slow process, partly on account of the de and impermeability of the nucleus of the lens, and partly consequence of the diminished activity in the interch of material which characterises the tissues of the body old age.

A more rapid removal of the opaque lens, therefore, beco desirable; and although special circumstances may induce surgeon to employ the operation for solution in patients ab forty, or even fifty years of age, he will find it preferable, in majority of instances, to have recourse to extraction.

Until within the last few years, the term 'Extraction,' had one meaning—the removal of a cataract through a flap wo of the cornea. But in 1855 Graefe re-introduced and modifi under the name of 'Linear Extraction,' an operation which first been devised by Gibson in 1811, and at a later period invented an entirely new operation in which, after removing portion of iris, he drew out the cataract with a scoop.* This

FIG. 147.

scoop, first invented by Graefe in 1857, was modified by one of his assistants, and on the strength of this mere change in the shape of the instrument the whole procedure itself became universally known, not as Graefe's—which it undoubtedly was —but as Schuft's operation.† Other surgeons in Germany have modified Graefe's invention in various ways, but their operations are all substantially the same in principle as that which he originally devised.

We may group the various forms of extraction under three heads :—*Flap-Extraction*, *Rectilinear-Extraction*, and *Scoop-Extraction*.

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* The woodcut is copied from a scoop made for Graefe in 1857.

† Schuft changed his name to Waldau.

FLAP EXTRACTION.

This operation, as now practised, cannot be said to have origi- ed with any one surgeon, but has been gradually perfected n a very rude beginning. Daviel has the credit of having formed it for the first time during the earlier half of the hteenth century; and he professed to have derived the first t of the operation from his countryman Petit, who, in 1708, had de an opening in the cornea to give exit to a dislocated lens. t Daviel's clumsy and complicated proceeding can only be re- ded as a very rough approximation to the delicate operations the present day. He first, with a lancet, punctured the cornea r its lower edge; then he enlarged the wound with a narrow ife, blunt at the end, but cutting on each side; and, lastly, mpleted his incision with scissors. Other surgeons simplified e operation by making the section with a knife only; they ntinued, however, to do this at the lower part of the cornea, ituation very unfavourable for quick union, inasmuch as the ge of the corneal flap was liable to catch against the lower sus, and so become displaced. B. Bell seems to have been e of the first to suggest the practicability of the upward tion; but it is difficult to say by whom this great improve- nt in the operation was really established. It seems to have de its way by slow degrees, commending itself to several lependent operators by its evident superiority.

It is to Beer that we owe, if not the invention, at least the tematic introduction, of the knife which still bears his name, d has superseded all other instruments for making the corneal tion. This, however, Beer continued to make in a downward ection.

But it was not exclusively, or chiefly, by means of improved struments, or by greater skill in using them, that increased ccess in the operation of extraction was to be attained.

The astounding plan of after-treatment which so long pre- iled, and the remains of which still linger among us, makes wonder, not that so many eyes were formerly lost after traction, but that any were saved. Low diet, carried to the rge of starvation—profuse bleeding, both general and local active purging and mercurialisation, and long confinement to rk rooms—formed a course of discipline by which surgeons ped to heal a wound inflicted on a structure devoid of blood-vessels, and peculiarly liable, therefore, to slough or ulcerate whenever its vitality was lowered by any exhausting agencies. These surgeons saw the cornea die in persons worn out with scarlet-fever, erysipelas, small-pox, or typhus; and yet, in the after-treatment of extraction, they seemed bent upon reducing the patient as near as possible to the same condition as those diseases would have done.

I shall have occasion hereafter to speak of the after-treatment of cases of extraction; at present we have to consider the operation itself.

The objects to be kept in view are the following:—

To make a crescentic opening in the cornea sufficiently large to afford an easy exit to the lens. To make the incision at such a distance from the sclerotic as to insure both edges of the wound being wholly of corneal tissue: for wounds of the true cornea, provided their edges are in perfect apposition, have a peculiar readiness to unite—a property not equally shared by that extreme marginal portion of the cornea which blends with the sclerotic. Freely to lacerate the anterior capsule, so as to allow of the lens readily slipping through the rent when pressure is made on the globe. Lastly, to apply this pressure in such a manner that the lens may be made slowly to turn on its transverse axis, and thus to present its upper margin first at the pupil, and then at the corneal wound.

If we reflect, that the surgeon's object is to dislodge and press out the lens, at the same time that he avoids pressing out any portion of the vitreous body, it must be evident that extreme care and delicate handling are necessary. The pressure must be regulated with a nicety which is hardly possible unless the operator has the eyeball under his sole management. The best position for the patient, therefore, is to lie upon a high couch, with his head alone slightly raised. The surgeon, standing or sitting behind him, can then control the movements both of the upper lid and of the eyeball. Formerly the patient was always seated on a chair, the surgeon sitting opposite to him, while an assistant steadied the patient's head, and raised the upper lid. But in this way it was impossible for the patient's head to be fixed as immovably as if it were resting on a couch; nor could an assistant, however careful, regulate the pressure he made on the eyeball in exact accordance with that exerted upon it by the operator.

The chief difficulty attending the formation of a proper section igh the cornea arises from the fact that the knife has to be ed across a chamber filled with a fluid, ready to escape at the lest opening which the blade of the instrument may leave arded; while the instant such an escape takes place, the icity of the contents of the eyeball forces the iris forwards the edge of the instrument. The sawing motion we employ sing a scalpel, or any other kind of surgical knife, would be missible in making a section of the cornea, inasmuch as to-and-fro movement of the blade would allow of a fresh pe of aqueous humour, or would inflict a wound on the iris, n that structure had come forward to fill up the place of lost fluid. Hence arose the necessity for a blade regularly easing in width and thickness from the point to the heel. h an instrument, if steadily carried on in one direction, out any rotation, completes the wound at a single thrust, le its wedge-like form prevents the premature escape of the eous humour, and so lessens the danger of wounding the

would be very unprofitable to enter into a description of various cataract-knives which at different times have been nted. One operator after another has endeavoured, by ations in the shape of the blade, to overcome the special culty which has most beset him; but surgeons are now ty generally agreed that the instrument which goes by the e of Beer's* knife is, with certain modifications, the most ul, and that no merely mechanical contrivance can obviate he difficulties attending the operation of extraction.

t the time when Beer wrote, and, indeed, long afterwards, flap was always made at the lower part of the cornea; but upper section has been found to possess such advantages, the lower one has completely fallen into disuse.

he patient being placed in the manner described, the surgeon ding or sitting behind him, raises the upper lid, placing

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It seems that both Casamata and Barth had employed a knife of the same e as Beer's, but larger. Casamata's knife, if correctly figured by Wenzel *uel de l'Oculiste*, 1808), resembled Beer's in shape, although there might me slight difference of size. Beer insists, with amusing earnestness, upon absolute necessity of the knife being made precisely according to his rn—so many lines long and so many broad; if people pretend to operate is way, and yet deviate from the exact pattern he has laid before them, he not hold himself responsible for the consequences. (*Lehre von den Augen-kheiten*, 1817, vol. ii. p. xlvi.)

his fingers against the very edge of the tarsus, so as to pre[illegible] eversion. An assistant draws the lower lid downwards, [illegible] keeps it fixed by making pressure against the malar bone. [illegible] must take especial care to do this, and not in the sligh[illegible] degree to press upon the eyeball. The surgeon may control [illegible] movements by allowing the tip of one finger lightly to [illegible] the sclerotic just above the cornea, while the other rests, [illegible] lightly, against the inner side of the globe. To do this [illegible] requires the greatest tact and care; for, as soon as the [illegible] has transfixed both sides of the cornea, all pressure must [illegible] and it ought at no time to be greater than will just suffice [illegible] enable the surgeon to make his puncture and counter-punct[illegible] with certainty. Firm pressure, kept up till the section is [illegible]pleted, will almost inevitably cause the lens to be viol[illegible] ejected, with a gush of vitreous humour.

The point of the knife is to be introduced on the equator [illegible] the cornea, a short distance in front of its junction with [illegible] sclerotic, carried steadily across the anterior chamber, [illegible] brought out at the corresponding spot near the inner margi[illegible] of the cornea. During this thrust the edge is directed towa[illegible] the upper margin of the cornea, so that, when the section is completed, a semi-lunar flap results.

The surgeon must take care to give the knife a steady onward pressure, so that the blade may constantly fill up the wound it is making. If he in the least withdraws the knife or rotates it, or if he attempts too soon to cut out, instead of thrusting straight on, a jet of aqueous humour takes places at that portion of the wound which is no longer filled by the blade, and then the iris instantly folds over the edge—one of the most troublesome occurrences that can attend the operation. The utmost care, however, will not always avail to prevent the loss of aqueous humour; for so ready is the fluid to spurt out, that, if the sides of the knife be unevenly ground, sufficient space may exist between the blade and the edges of the wound to allow of the escape.

If the iris has fairly come over the edge of the knife, the surgeon may disengage it by drawing the point of one finger over the cornea, from below upwards, and then making a little pressure directly backwards. In this way the iris may be made to slip back behind the edge, and by keeping up careful pressure until the section is nearly completed, the iris may be prevented from coming forward again. It is not possible precisely to describe this manœuvre for disengaging the iris; the pressure employed should be extremely delicate and guarded, and should be wholly taken off before the very last portion of cornea is divided.

The operator may find it impossible wholly to disengage the iris from the knife, and a portion of the upper margin of the pupil may be cut away. This of course causes a slight bleeding into the anterior chamber, which obscures a view of the parts during the next stage of the operation, but the lens usually escapes readily through the artificially enlarged pupil, and, except the deformity, no permanent bad result necessarily follows the accident. Sometimes, however, it happens that a *fold* of the iris is cut through, so that there results a hole in the iris just above the true pupil. When this occurs, the surgeon must at once divide the strip of iris between the two apertures, so as to lay them into one before he proceeds to lacerate the capsule.

As soon as the corneal flap has been completed, the upper lid is allowed gently to fall, care being taken that it does not catch against the edge of the flap and evert it; and the surgeon proceeds to the second stage of the operation—the division of the anterior capsule.

After a short pause, he again carefully raises the upper lid, without making pressure on the globe, and surveys the wound. If he has made it too small, he must at once enlarge it, by passing a short, narrow, blunt-ended knife, or the blade of a pair of scissors, under the flap, to the outer angle of the wound, and carefully dividing the cornea close along its margin, in a downward direction.

This enlargement of the original wound is always very difficult, on account of the unresisting state of the loose flap of cornea, and the irritability of the eye, which the surgeon dares not then control by pressure, for fear of prematurely displacing the lens. An able assistant, who can be trusted not to press upon the globe, may often render good service in this difficulty, by nipping up in a forceps a fold of conjunctiva, just below the cornea. Scissors curved on the edges will be found preferable to the knife for enlarging the wound. No difficulty should deter the surgeon from making the wound sufficiently large before attempting to press out the lens; for if, while the opening in the cornea is too small, pressure be made on the globe, the hyaloid membrane will probably give way, and allow a portion of the vitreous humour to escape; and immediately the lens, inste of presenting itself at the section, sinks down into the sp left by the lost humour.

When this occurs, the surgeon must at once desist from pressure on the globe, and pass in a fine sharp hook through th now gaping wound, and through the pupil, to the hinder surf of the lens, which must be drawn out as quickly and as light as possible. Sometimes it is better to pass in a flat scoop inste of the hook; but, whichever instrument is employed, it must placed *behind* the lens, which is to be kept well pressed again the cornea, otherwise it will be driven still deeper into th vitreous humour.

If the surgeon has satisfied himself that the corneal wound is sufficiently large to allow of the easy exit of the lens—and for this purpose it ought to involve nearly half the circumferen of the cornea—he next proceeds to lacerate the anterior cap- sule. The curved needle* is slipped under the corneal flap, care being taken not to entangle the point in the iris; and when its curve is fairly in the pupil, the handle is rotated so as to bring its point against the capsule. Some writers give very precise rules as to the manner in which the capsule is to be divided. One recommends a crucial incision; another tells us to make a series of cuts crossing each other at right angles, so that the lines of incision may include a number of lozenge- shaped interspaces—a figure, one would think, rather difficult to execute within the area of the pupil, even in a motionless dead eye, and certainly not practicable upon the irritable eye o a patient under operation.

In tearing through the capsule, the surgeon should take ca that the rents extend quite across the area of the pupil; a if he effects laceration to this extent, he need not trouble hi self about lines of incision depicted in diagrams. The lace f the capsule requires a careful eye and a light hand, rise the lens itself may be displaced, the capsule remain- ibroken.

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* By a curious misnomer, this needle is commonly termed in England ‘curette.’ The mistake arose from an accidental circumstance. The instrum for lacerating the capsule was originally called by the French *cystitome*; scoop, attributed to Daviel, was called *curette*. It was found convenient mount these two instruments on the opposite ends of the same handle; and countrymen, forgetting the meaning of *curette*, have applied that name to sharp cystitome instead of to the scoop. It is time that we called the things their right names; for foreigners, in reading reports of English cases, m often have been sorely puzzled to understand how we lacerated a capsule, transfixed a lens, with a *curette!*

needle having been withdrawn, with due care against gling it in the iris, the surgeon proceeds to the last act of eration—the removal of the lens.

s a fatal error to suppose that this removal is to be d by main force; that the eye may be squeezed in any on, if only it is squeezed hard enough. The real object sure is to make the lens first turn on its transverse axis, its upper edge may become tilted a little forwards. To his, the concavity of the scoop is laid against the lower hich the assistant is not to touch during this stage of the on—and gentle pressure is to be applied through the lid the sclerotic, a little beneath the lower margin of the With the forefinger of the hand which holds the id, similar gentle pressure is made on the upper part of be, just above the section; and then, by a carefully- ed alternating pressure on these two points, the lens is lowly to turn and present its upper edge at the pupil. in contact with the cornea, the edge of the lens is upwards, and begins to protrude at the corneal wound. ident that as soon as the widest part of the lens has through the pupil, the rest will be inclined rapidly to and therefore, if the surgeon does not moderate his e, the lens will suddenly start forward, and will very y be followed by a gush of vitreous humour. According ize of the corneal wound, and the degree of superficial ıg the cataract has undergone, will be the amount of tter the lens will leave behind in passing out of the eye. l lens will perhaps escape entire through a large wound; f the wound be small, and the lens bulky and much d on its surface, a considerable quantity of lens-matter nain in the pupil and about the lips of the wound.

k union of the corneal wound, upon which so much of cess of the operation depends, cannot take place if any matter be allowed to remain between its edges; all is-matter, therefore, which may be sticking there, must fully removed with the scoop. The iris, which very tly protrudes, can be best returned to its position by f the small spatula. It is unwise to dip again and again pupil with the scoop for the purpose of removing every portion of soft lens-matter. The capsule cannot be remo such means; and it is to this that the fragments ver adhere, and a too free use of the scoop is very likely t ture the hyaloid membrane, and cause a gush of vi humour.

Provided the lips of the wound are in perfect appositio the iris in its proper place—which may be known b central position of the pupil—the capsule, and any smal tions of entangled lens-matter, may safely be left for removal, after the wound is healed and all irritation away.

When a gush of vitreous humour takes place at the m the lens passes, the surgeon must immediately close dow upper lid, lifting it over the wound by the eyelashes, so prevent the edge of the tarsus catching against the proj flap of cornea. Any prolonged examination of the wou only lead to fresh escape of vitreous humour. After a pause, the surgeon, again grasping the lashes of the upp may gently raise it, just sufficiently to assure himself t flap is not doubled down, as frequently happens. ascertained that this displacement has not occurred, h be satisfied, and not wait in the expectation of seei wound close; for the constant tendency of the vitreous to escape will render any adjustment of the flap imp The lids must at once be closed with strips of plaster bandage.

Although cases in which a small quantity of vitreous has been lost may ultimately do well, a deformity of th always remains. It is large and drawn up towards the and the iris forming the upper margin of the pupil retr as to disappear altogether.

In the foregoing description of the operation by extra have noticed some of the accidents that are liable to occ there remains to be noticed one more dangerous than all namely, *hæmorrhage into the vitreous chamber.*

Although the corneal section may have been perfec made, and every due precaution taken, it sometimes that a gush of vitreous humour, usually of watery cons occurs at the moment the lens escapes through the Within a few seconds, or at the end of a minute or patient complains of severe pain in the eye, and blood oozing from between the lids. This oozing does not tak

matous projections of the globe. As soon as the promi-
tion of the staphyloma has been cut off, the pent-up
fluid and serum, and the diffluent vitreous humour,
; at the wound; and this sudden removal of support
enlarged choroidal vessels causes them to give way.
cases, I have found the whole retina enveloping the
t which had been forced out of the eyeball; a proof
blood which had detached the retina must have had its
ehind that structure, namely, from the vessels of the

AFTER-TREATMENT OF CASES OF EXTRACTION.

:evalent belief that all operations for cataract are likely
:owed by 'inflammation,' and that the great aim of the
is to keep this down, is of course unqualified in the
mind by any definite notion as to the nature of this
ıation,' why it arises, or what parts of the eye it in-
nd many members of the profession, when commencing
y of eye-diseases, have equally vague conceptions of
ect. Let us, then, examine a little into what takes
an eye after flap-extraction of cataract. We will
:hat the structure of the organ, with the exception of
had been in a healthy condition, and that the opera-
been skilfully performed.

body is in a healthy state—adhesion takes place between the cut edges of the cornea. As this adhesion becomes firm, the aqueous humour is retained; it once more fills the anterior chamber, and defends the iris from being pressed against the cornea. The slight irritation to which the iris had been subjected, by the passage of the lens through the pupil, passes off, and within a period longer or shorter, according to the constitution of the patient, the extra quantity of blood, which had been affording reparative material to unite the wound, ceases to be sent thither, and the cure is completed.

This is just what happens in accidental wounds of the cornea. If the patient be at the time in a good state of health—the wound a clean cut, unattended with contusion—with no iris or other substance interposed between its edges—and if the eye be carefully kept at rest, and defended from the action of light and other irritants—a few days suffice to heal the wound. But let a similar injury be inflicted on the eye of a person feeble from age—or of one reduced to feebleness by want—or of one alternately excited and depressed by intemperance—and suppose the first two patients to be bled and restricted to low diet, while the third continues his indulgence in alcohol—what will *then* be the result? Non-union of the wound; partial or total slough of the cornea; and morbid changes in the iris and adjacent tissues; finally, loss of the eye, as far as sight is concerned.

And now let us apply these facts to a case of extraction. If the operation has been properly conducted, and all has gone well, in the manner already described, healing of the wound is the natural result. No more blood will be sent to it than the healing-process requires; and as soon as the process is completed, the extra supply will cease.

On the other hand, if the iris has been forced into the wound, a mechanical obstacle to quick union is thereby established, and union must take place by a slower process, effused lymph agglutinating the iris to the cut edges of the cornea, and then gradually drawing them together. If vitreous humour has escaped through the wound, its edges will be kept asunder for some time, but will eventually unite by adhesion.

If quick union is prevented by these or any other causes, what good can *bleeding* do? Will it dislodge the iris from between the lips of the wound? or, when the hyaloid mem-

m has been excited by anxiety about the operation
ɘsult. Bleeding is sure to increase this neuralgia;
supply of digestible food, a small quantity of
a narcotic, will at once arrest the neuralgia and
ecurrence. And yet, only forty years ago, such
;he following were taught *ex cathedrâ*, and are still
followed by many in this country, and by a far
ɔer of surgeons on the Continent:—that within
after the operation of extraction a quantity of
always be abstracted, *whether pain come or not*;
ı four to eight hours after the operation, unless
ıe on sooner, blood is again to be drawn from a
'—and yet again, 'if pain should come on after-
tinue.' For the first five days after the operation
ɔatient is being drained of blood in this manner—
consist of 'nothing but gruel, tea, arrowroot, and

of cataract is an operation performed on those
the middle period of life, and one naturally expects
g them many of those conditions of feebleness and
ıction which are incident to old age. No doubt
of an opposite kind, in which the patients are
er-fed, over-stimulated with alcohol. They require
down,' and their circulation brought into a more
e. But then this should be done by regulating

eye; although he did not so completely abandon bleeding as I am convinced he would have done had he been spared to acquire firmer faith in the *vis medicatrix naturæ*.*

As soon as an operation of extraction has been completed, and the surgeon has satisfied himself that the flap is in a proper position, he should at once close the eye, without permitting any such trials of the patient's sight as may safely be made after the removal of opaque capsule, or the formation of an artificial pupil. Such trials, immediately after extraction, are more likely to disappoint than to satisfy the patient; for when the media of the eye have just been disturbed, and the pupil is still encumbered with shreds of capsule, and perhaps fragments of lens also, objects must necessarily appear to the patient distorted and confused; whilst the opening and shutting of the lids is liable to displace the corneal flap. An assurance from the surgeon that all has gone well, and that, to restore good sight, time and patience only are needed, will effect much more towards tranquillising the patient than any premature experiments.

Both eyes are to be covered with pieces of folded linen, which are kept in place by a light bandage passing around the head. Some surgeons apply strips of plaster across the lids, instead of a bandage; but I prefer the latter, as it effectually excludes light, and therefore does away with the necessity for darkening the room, while it affords to the patient a sense of security and protection. Liebreich's bandage is a great improvement on the old linen blinkers and roller; for it always keeps in place, and can be unfastened without moving the patient's head. A little square of linen is laid upon the closed lids, and over this a little pile of cotton-wool, and the whole is then fastened down with the knitted bandage.

For some hours after the operation the patient should remain on the couch, comfortably supported with pillows. When in bed the best position is on the back; but this is by no means to be insisted on if it becomes irksome, or makes the patient wakeful. That position is the best which is the most comfortable, and likely to induce sleep.

A narcotic is sometimes needed on the first night; and in some persons, especially those accustomed to opiates, it may e to be repeated for several nights in succession; but ases form the exception, not the rule. Loss of appetite is to follow the use of these drugs, that they should never en without manifest necessity. I always prefer tincture scyamus to opium, as being far less likely to cause disrt the next day or to confine the bowels.

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* For much valuable information on this subject, consult vol. ii. of his *Practical Work*, &c.

patient is of course to be thoroughly waited upon, so as spared every unnecessary movement or exertion. Tapes round the wrists and attached to the sides of the bedstead useful check upon sudden movements of the hands during

noderate dose of opening medicine, given a day or two the operation, will obviate the necessity for teasing the t with purgatives during the first few days succeeding it. d feeble persons, especially those with any heart-disease, netimes seriously prostrated by being purged on the second d day after the operation, just when it is so important e healing process should be steadily advancing.

egards diet, patients should not be deterred from taking itious meal a suitable time before the operation; and a ate quantity of easily-digested animal food should be on each following day. In respect of stimulants, it is ible to lay down any absolute rule. Those accustomed e wine, beer, or spirits, must by no means be wholly ed from them at a time when the nutrient power of the s called upon to form new material for repairing a breach face. In short, the surgeon's object must be carefully to te both food and stimulants according to the patient's us habits; neither keeping him too high nor too low, near as possible up to the ordinary level of healthy

daily cleansing of the lids requires caution; the object ing to prevent the eyelashes sticking together, for their ination forms the best safeguard against the patient preely opening the eye. The lower lid and cheek are to be ed with warm water, but the upper lid is on no account touched, for under its shelter lies the corneal wound, pressure on which would induce great suffering, and even cause the slightly-formed adhesion of the flap to ay.

progress of the wound towards healing is to be judged of condition of the lid, and the quality of the secretion. If

the patient complains only of an occasional pricking, or a se
tion of grit; and if this can be traced to the slight involu
movements of the wound against the lid ; if this uneas
subsides day by day ; if the secretion consists of tears alo
is mixed with a little of the natural conjunctival mucus ;
the skin of the upper eyelid retains its healthy appea
and is free from redness and swelling—the surgeon may
tain the best hopes that a good union is going on.

An increased feeling of grit in the eye, coming on aft
lapse of three or four days, and perhaps attended with neu
would lead the surgeon to suspect that the section had
and that *prolapsus iridis* had occurred.

The most unfavourable sign is a bright redness and a s
of the upper lid, which sometimes appear on the sec
third day after the operation, attended with a yellow p
discharge. These appearances are commonly ushered
restless night, with headache and considerable depression
body and mind. When the lid is raised, the ocular c
tiva is found injected, and so œdematous that it overl
corneal margin (*chemosis*). The cornea itself is thro
yellow and opaque, so that no trace of iris can be di
through it; the wound is gaping, and filled with bulgi
Eventually the whole cornea softens, the flap sloughs,
eyeball shrinks.

I have now and then seen this hopeless state of thin
on after an operation, which had been perfectly well per
and when the surgeon had every reason to expect a m
cessful result. In such cases there has probably bee
degeneration of tissue in the vessels supplying the globe
weak condition of the heart itself.

The time that should be allowed to elapse after the op
before the eye is examined, may vary according to circum
In a healthy patient, when there has been no pain in th
other bad symptom, the wound may be found perfectly
as early as the third day after the operation. But, as
the fourth day is quite soon enough for an examinati
whenever there has been any loss of vitreous humour,
the healing process has been retarded, the fifth will
earliest day on which the eye can be prudently exposed.
in an old or feeble person, a wound which on the fourt
going on well, will be all the better for another day of re
it often happens that a premature exposure sets up ir

if the union be not firm, favours the subsequent yielding wound and prolapse of the iris.

redness of the upper lid, attended with puriform discharge, on within the first two or three days, the surgeon should ine the eye just so far as to obtain a view of the lower of the cornea, and ascertain whether it is becoming infil- d with pus; and this may be done without exposing the d itself.

would be impossible to detail all the appearances which an may present when first examined after the operation; but y be useful to describe some of the leading points which nt themselves, both in favourable and in unfavourable

The cornea may be transparent, with the exception of a hazy line along the edge of the wound; the aqueous ur may have been resecreted, and the plane of the iris al; the pupil being either clear and black, or filled with a lent mass of capsule and lens-matter, accordingly as the has come out clean, through a large wound, or has rubbed me of its soft cortical substance in passing through a small Vision may extend to the recognition of large objects, as the fingers of a hand; or, in consequence of the obstruc- still remaining in the pupil, may be limited to mere per- on of direct or reflected light. Some little redness of the otic and conjunctiva will of course be present in every case, dditional supply of blood having been sent to repair the al wound.

e appearances above described are most satisfactory, and d encourage the surgeon to look forward to a successful lt.

The eye may present all the foregoing appearances, with exception of the iris being in contact with the hinder sur- of the cornea. This absence of anterior chamber arises n one or other of the following causes: either the wound, ough sufficiently united to keep the cornea in its proper re, has not become so consolidated as to be perfectly water- t, and the aqueous humour therefore escapes as fast as it is ned; or else this fluid, which seems to be chiefly secreted in posterior aqueous chamber, may be so pent up there by the -matter filling the pupil, as to thrust the whole iris forwards nst the cornea. In the former case, by keeping the eye ed for two or three days longer, and giving the patient a

small portion of the iris to protrude, so as to cause
placement of the pupil.

3. The eye may be found in the following state: t
clear, the section gaping, and blocked up with iris,
having prolapsed into the wound, after being adjus
operation, and no union between the two structur
occurred, in consequence of the feeble condition of th
In these cases the parts on the fourth day after the
may appear almost as if the wound had been just
Chronic inflammation is sure to be set up, and is ofte
with neuralgia. In non-union of this kind, it is somet
practice to keep the eye uninterruptedly closed for
days after the first examination, provided the health
ance of the lids, and the absence of puriform secre
assurance that the healing process is advancing.

4. Still more unfavourable than the appearances
scribed are the following: in addition to a gaping s
prolapsus iridis, a cornea hazy throughout, so tha
cannot be clearly discerned; the edges of the wound
opaque, and creamy-looking; the sub-conjunctival ti
trated with serum, and the conjunctiva itself redd
elevated (*chemosis*).

These local changes have usually been ushered in
in the eye and head, restlessness, and depression.
care is necessary to treat a patient under such circu
Narcotics will probably be required at night: of these

subsequent depression. But it will sometimes happen, in of care and skill, that such cases as these will terminate losure of the pupil, with wasting and softening of the whole

lthough it is so important, after the operation of extraction, fend the patient from strong light for several days, there necessity for closing shutters, and drawing curtains closely d the bed, if the patient's eyes have been bandaged in the ner I have described. Very moderate shading of the room then sufficient, and thorough ventilation is most beneficial; due aeration of the patient's blood is essential to the healing cess.

Prolapsus iridis.—If the corneal section, instead of uniting by sion, has undergone that slower process of closure which place when a portion of iris is interposed between the of the wound, the *prolapsus* continues for some time to a source of irritation. It should not, however, be too hastily fered with; for, in healthy subjects, it usually wastes and tens down by slow degrees. Sometimes, however, instead of inishing in this manner, it becomes distended into a little cle, in consequence of the accumulation of aqueous humour hind it. If the prolapsus fills up nearly the whole extent of the wound, the corneal flap may be tilted forward in such a manner as to form an obtuse angle with the lower portion, the base of the flap being marked by a transverse crease, extending quite across the cornea from one angle of the wound to the other. As the process of contraction in the prolapsed iris goes on, the edges of the corneal wound are gradually drawn together, the transverse crease disappears, and the natural curve of the cornea is eventually restored.

If, however, instead of diminishing, the prolapsus remains as a large and prominent vesicular projection several weeks after the operation, means must be taken to induce it to contract. In many cases it is sufficient to puncture it with a broad needle, and, when the aqueous humour distending it has escaped, to touch the collapsed iris very lightly with a point of nitrate of silver. The eye must then be kept closed for a day or two. Should the prominence reappear, the application of the nitrate of silver may require to be repeated; but it must never be used except with a light hand, a single touch being sufficient to whiten the surface.

Fistulous wound.—If a case be not well watched for several months after the operation of extraction, the wound may beco fistulous. This is an extremely rare occurrence; so rare, inde as to be unnoticed by most of the authors on ophthalmic surge On this account, I will relate two cases which occurred under own observation. In the first case, I could not quite satisf myself as to whether the fistula resulted wholly from defectiv repair of the original wound made in extraction, or whether i was the consequence of a puncture I made in a very troublesom vesicular prolapsus.

In the second case, the prolapsed iris gave way spontaneou many months after extraction, when the cure might have bee considered complete.

1. Captain G., aged seventy-six, was operated on by extraction in the righ eye, November 18, 1854. Nothing untoward occurred during the operation, and although a small portion of iris subsequently prolapsed into the wound, there was every reason to expect that its contraction and solidification woul take place in the usual manner. By the end of the month, however, the prolapsus, instead of flattening down, became distended at one spot into a litt vesicle. Meantime the pupil had of course become somewhat drawn upward and it was also obscured by a hazy condition of the flap; the lower half of th cornea always retaining its perfect transparency. On January 19, 1855, th vesicle still existed, and the anterior chamber had never been restored sin the operation, the iris lying in contact with the cornea. It appeared to m therefore, that at some part of the cicatrix a minute aperture must exist whi allowed the aqueous humour slowly to exude. I punctured the vesicle with cutting-needle, and touched the collapsed surface with a fine point of nitrate silver. Three days later, I again touched it in the same manner. Afte time the vesicle again became prominent; and on February 1, by the aid of lens, I distinctly recognised the existence of a fistulous opening at its summ The aperture was as minute as the section of a human hair, but pressure the globe caused an escape of aqueous fluid to be distinctly perceived. I n coated a fine hair-like probe with a thin film of nitrate of silver, passed quite into the minute fistulous track, and then kept the eye closed for seve days. Meantime the patient's diet and allowance of stimulants, which h been liberal from the first, were increased. March 12, the vesicle had flatte down, but slight oozing from the fistula still continued. Nitrate of silver the fine probe was twice repeated, at an interval of some days. By the end May, the cicatrix of the wound was quite flat, but a very slight oozing aqueous humour still continued; so slight, indeed, that some little accumulat took place in the anterior chamber, so that the iris and cornea, although v close together, were not in actual contact.

It was now evident that it would eventually be necessary to draw the p downwards, from behind the hazy portion of cornea adjoining the cicatrix, so bring it opposite the clear portion below. But of what avail would this unless the fistula could be closed? It appeared to me, that by at once perfo ing this displacement of the pupil, a double object might be attained, and t the wound made at the lower part of the cornea would for a time effectu drain off the aqueous humour, diverting it altogether from the fistula, wh would thus be placed in a condition favourable to closure. Accordingly, on May 30, I made an opening at the lower part of the cornea with a broad needle; caught the lower edge of the pupil with a blunt hook, and drew out and cut off a very small portion of iris. An excellent pupil resulted. Ten days after the operation, I was much pleased to find the fistula closed and the aqueous humour completely retained, and this after a lapse of more than six months from the performance of extraction. Two years later, the patient was still enjoying excellent vision, both for far and near objects, reading the editorial articles in the *Times* with a glass of two inches and a half focus.

In the foregoing case I had been induced, by special considerations, to perform extraction at a very late period of the year; and the winter, which soon afterwards set in, was unusually cold and protracted. It will long be remembered as the terribly severe winter of the Crimean campaign. No doubt the low temperature contributed to lessen the reparative power of so old a person; and the long continuance of frost and cutting winds, which kept him confined to the house till May, deprived him of the invigorating influence of exposure to the open air.

2. An elderly woman, from whose left eye I had extracted a cataract in 1857, came to me two years afterwards, complaining that the sight of this eye, which had been very good ever since the operation, had within a few weeks begun to fail. On carefully examining the eye, I observed that near the middle of the cicatrix, which was rather broad in consequence of some slight prolapsus iridis having followed the operation, there was a minute fistula, through which the aqueous humour was slowly oozing. The anterior chamber was nearly full, and the plane of the iris almost vertical, the escape through the very minute aperture being counterbalanced by the secretion of fresh fluid. The fistula was so minute that it might easily have escaped notice, and it was only by absorbing the moisture adjacent to it with a bit of blotting-paper, and protecting it from the trickling-down of the tears, that the welling-up of the aqueous humour could be positively demonstrated. I had no doubt that this fistula was of very recent formation, for otherwise the patient would not have enjoyed such good sight as had existed until within a few weeks of her coming to me. Probably the cicatrix had always been thin and tense, and now from some accidental cause it had given way at the weakest point.

At first I tried the effect of touching the fistulous orifice with a fine probe coated with nitrate of silver. This was done twice, and for a few days after the second application it appeared to have been successful; but again the little channel opened itself. I then made a counter-puncture with a broad needle at the lower part of the cornea, and let out the aqueous humour, having just before again introduced the fine probe coated with nitrate of silver into the fistulous orifice. The lids were kept in contact with strips of plaster. A week later the fistula was completely closed, and sight was improving.*

These fistulæ of the cornea are likely to be overlooked, on account of their extreme minuteness; for their aperture is sometimes no larger than the section of a human hair, and the quantity of fluid oozing out is small in proportion. The fistula

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[*] This case was reported in the *Medical Times and Gazette* for August 27, 1859.

of course allows a constant escape of aqueous humour, and the anterior chamber becomes obliterated, the iris lying in contact with the cornea. This drain of aqueous humour, if unchecked, seems to exert some peculiarly exhausting influence upon the eye, for in all the cases I have seen in which fistulæ of the cornea had existed for several years, all useful vision had become extinct.

There are certain points connected with the operation of flap extraction which may seem to have required notice before the operation itself was described; but it appeared preferable to reserve them for later consideration, because they can be properly appreciated by those only who have already made themselves acquainted with the details of the operation.

Inasmuch as extraction is performed upon persons more or less aged, it must often happen that the constitution of such patients has been damaged by various forms of acute or chronic disease before they come under our care as the subjects of cataract; so that we cannot expect to find them by any means in as favourable a condition for undergoing an operation as those whom we are in the habit of treating for many other surgical affections. There are, however, certain conditions which would either wholly contra-indicate extraction of cataract, or would cause us to undertake the operation only after the most careful preliminary examination, and unusual precautions against the more pressing difficulties of the case.

1. Extensive heart-disease is of all complications the most unfavourable; for, by enfeebling the supply of blood to the peripheral tissues of the body, it lessens the probability of a quick union of the corneal wound.

2. Violent cough, if occurring in suffocative paroxysms, would also greatly imperil the success of the operation; partly by the unavoidable restlessness and frequent change of posture, and partly by the straining and shaking of the eye, which may disturb the wound, and induce prolapsus of the iris.

3. Fat and flabby persons have much less reparative power than those who are thin. Dry and wrinkled, but still vigorous old people—such as are popularly termed 'wiry'—are of all others the best adapted to undergo extraction.

4. Certain morbid conditions tend to render the operation in various ways difficult, although they by no means forbid its performance. Total deafness, and deaf-dumbness, for instance, is

reat measure remove the patient from control; but I have cessfully operated on patients under both these disadvan- es.

5. Mere old age does not contra-indicate extraction; for one asionally meets with persons of advanced years whose bodily ctions are performed with surprising regularity.* Commonly, wever, the reparative power of the cornea is impaired after enty.

. If cataract is equally advanced in both eyes, and both appear ally well suited for operation, ought we to extract both lenses one sitting? On this question much difference of opinion ts. My own judgment is decidedly in favour of operating one eye only at a time. We learn much by watching the gress of a case after operation, and often see how, by this or t precaution, or course of treatment, a difficulty or a bad ult might have been avoided. We operate, for instance, on epressible patient during very hot weather, and find him rly overcome and prostrated by it, perhaps to such an extent o induce non-union of the wound, or even partial slough of cornea. Were this to occur after we had operated on one only, we should learn experience by the result, and take e to select a cooler season of the year for operating on the er eye.

r our patient may have deceived us as to his previous habits. may for years have been accustomed to take large quantities stimulants, and our first operation may have failed because had not kept up his reparative powers sufficiently by artificial s. Having learned the truth, too late to save the first eye, might be able, by adopting a different plan of after-treatment, save the second.

Without unnecessarily multiplying illustrations, I may say t by operating on one eye at a time we secure to ourselves advantage of making our first operation a means of invalu- e instruction with respect to the second; while, at the same e, the effort of nature in repairing a single corneal wound is course less than is required for the repair of a second wound equal extent.

Such was the case with a gentleman of eighty-six, upon whom I operated xtraction. I could really detect in him no organic defect whatever, and he d six years after the operation, in the enjoyment of excellent health and d sight. He then suddenly fell ill, became jaundiced, and died after a few s' confinement to his bed.

7. Ought we to operate when cataract is fully formed in one eye, while the other is either free from cataract, or only slightly impaired by its existence in an early stage?

Exceptional circumstances may make it desirable in such a case to operate on the cataractous eye; but in the great majority of cases it will be proper to wait until cataract is fully established in the other. Of course, after the extraction of the crystalline lens, a convex glass becomes necessary, to compensate for that portion of the optical apparatus of the organ which has been taken away; and it is almost, if not quite, impossible so to adjust any mechanical aids as to make the operated and the unoperated eye work well together. Each eye, taken separately, may be good; but there is a want of harmony between them which can never be reconciled.

8. The last question to be considered is, whether any particular time of the year is to be preferred for the performance of extraction? As far as the mere operation itself is concerned, I know of no period being positively contra-indicated, except the extremes of hot and cold weather. Severe cold acts unfavourably on old people by retarding the circulation of blood in their capillaries; while extreme heat enfeebles the action of the heart, especially when it happens—as is so common in old age—that some organic change has already taken place in it. The only time which I systematically avoid for performing extraction is during that sultry weather which sometimes visits us in July and August.

But one has to consider not merely the operation itself; the period of complete repair and convalescence is equally important. It is of the utmost consequence that a patient who has gone through the confinement and the mental anxiety inseparable from so important an operation as that for cataract, should at the earliest possible period enjoy the invigorating influence of change of air; and nothing tends so much to prolong that condition of chronic ophthalmia, which sometimes follows extraction, as too long a confinement to the sick-room. A few days of careful exposure to the fresh air during genial weather equally improves the eye and the patient's general health. It is, therefore, of importance so to time the operation that the period of convalescence may coincide with the finer season of the year; and this can only be done by choosing the spring and early summer for the operation: April, May, and June are, therefore, the best months to select for extraction, although the later mer months may be chosen, provided the weather be not ry and oppressive.

RECTILINEAR EXTRACTION.[*]

his operation is, as I have already observed, a modification hat invented by Gibson.[†] He advised that *soft* cataracts ld be freely broken up with a needle, and that after inflam- ion had subsided—in three or four weeks—a small incision ld be made in the cornea, and the broken-up lens removed a scoop. As the true principles which regulate absorption cataract in its natural position, when its tissue has been fully broken into with a needle, became better understood, on's operation fell into disuse. The fallacy of his procedure revealed by the words 'after inflammation had subsided.' y breaking up all the lens at once inflammation was set up, proper practice would have been at once to evacuate the -matter which was the cause of the inflammation. Either do or adopt the slower, but safe course of only disintegrating lens sufficiently to induce the absorbing process, without wing the bulk of it into the anterior chamber all at once.

raefe's operation [‡] was the following. After having dilated pupil with atropine, he made a straight vertical incision, two, and a half, or three lines long, through the cornea, not at nargin, but about a line nearer its centre. Such a 'linear' nd, he remarked, would heal more readily than a flap nd, and would involve less risk of *prolapsus iridis*. But, on other hand, a rectilinear wound does not gape, and it there- requires more manipulation to evacuate the pulpy lens- er. Through the wound he passed in a small fleam-shaped tome, and with it broke up the capsule and the substance he softened lens. Then a scoop was introduced into the t of the pulpy mass, the wound was made to gape, by press- the instrument against its edge, and the broken-up lens- ter escaped along the groove.

Linear extraction' was not proposed by Graefe as a substitute

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I have taken the liberty of using the word 'rectilinear,' instead of 'linear' erm by which Graefe designated his operation), because the wound made in cornea is a straight one, in contradistinction to that of a flap extraction, h also forms a line, but a curved one.

Practical Observations on an Artificial Pupil, with remarks on the Extraction of Cataracts, 1811.

Archiv für Ophthalmologie, ii. 217, 1855.

for the older flap operation. He considered it to be speci suitable to cases of fluid lens, the corneal wound being ma about two lines long; or when the lens was almost of a pul consistence, rather a longer incision being then required. Wh the lens had retained the normal consistence of adult life, an still more when in old age it had acquired increased hardne he considered the operation contra-indicated.

In consequence of these limitations of the operation being disregarded, and its being applied to cases of firm cataract, it soon fell into discredit. I knew of many eyes being lost after linear extraction which, from the skill of the operators, I hav no doubt would have been saved if treated by them on the slow but safe plan of solution *in situ*, or by flap extraction.

Removal of cataract by suction.—In 1847 Laugier announced a quick and easy method of removing softened cataracts by su tion; 'par aspiration,' as he termed it. He thrust a sort o cannula through the sclerotic into the substance of the lens and then professed to draw out the contents of the capsule b means of a piston.* A less dangerous mode of operating wa soon afterwards proposed by Blanchet, who employed a cannul and syringe somewhat similar to Laugier's, but with the muc safer modification of introducing the cannula through a woun in the cornea. Suction fell into disuse, until it was revive under a much more delicate and skilful form, by Teale,† in 186 With two needles he tore up the capsule; then made a sm wound in the cornea, through which he introduced a flatten cannula, or curette, into the body of the lens. A flexible tu attached to the curette terminated at the other end in a mout piece, and the operator gently sucked out the softened le matter. A syringe has sometimes been substituted for the tu The reader will at once see that this must needs be a v delicate proceeding, and that if a too great power of suction employed, serious mischief to various tissues of the eye m ensue.

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* *Annales d'Oculistique*, vol. xvii. p. 29. Laugier's operation gave occasio a paper war, which soon grew into formidable proportions. First he charged with having plagiarised his operation from some Italian surgeon; t an angry combatant declared that the Italian was himself but a plagiarist, had been anticipated by the Arabians of the middle ages. Overlooking fact that the Arabians did not know what a cataract was, nor where it their modern champion quoted Arabic and even Hebrew to prove their cl to priority of discovery. (See *Annales*, vols. xvii. xviii. xx. and xxiv.)

† *Ophthalmic Hospital Reports*, vol. iv. p. 197.

any cases of cataract it is impossible to determine abso- o what extent the softening process may have extended, at amount of hard nucleus may still remain. It often ed, therefore, that the surgeon who had commenced the ear operation in the belief that the whole lens was pulpy, imself embarrassed by a firm nucleus of considerable The removal of this mass required so much mechanical rence, that the iris became bruised and injured, and also nts of lens might remain behind the iris and set up the rious irritation. These and other complications seem to d Graefe to devise a mode of operation whereby the iris be saved from injurious pressure, and at the same time nal room might be made for removing even a firm nucleus h a corneal wound smaller than that made in an ordinary traction. The result of these attempts was the operation p extraction.

here I would observe that, whatever may be the final which, after more extended experience, may await the on of scoop extraction, its invention is wholly due to , who to a great degree has been deprived of the merit of originated it.*

e is no doubt that one of the chief causes of failure after performed flap extraction, is the occurrence of prolapsus and by the iridectomy proposed by Graefe all possibility are in an intermediate condition between the semi-fluid st which admits of a complete evacuation through a rectilin incision, and the hardness of those in which little or no sup ficial change has taken place.

From the diminished risk of escape of vitreous humo during scoop extraction, in consequence of the smaller cor wound and the absence of pressure on the globe, the vomiti which so often follows the use of chloroform is of less con quence than in flap extraction; and therefore it may be admini tered in operations with the scoop, although in very q patients it may not be necessary.

The lids being well separated with a spring speculum, t surgeon fixes the globe, by nipping up a fold of ocular conju tiva below the cornea. He then passes in a lance-knife at t upper edge of the cornea close to its junction with the scleroti Next a forceps is passed in at the wound, a portion of iris sei drawn out, and cut off.* The cystitome is then used to lacer the anterior capsule, which should be done to the full extent o the now enlarged pupil. Lastly, the scoop is insinuated behin the upper edge of the nucleus, and carried on until the beak o the instrument has passed just beyond the lower edge. Th entire nucleus is then gently drawn out.

This sliding of the scoop behind the lens is the act of th operation which requires the most care, for by rudely thrusting the instrument too much backwards, its point might be made to break through into the vitreous humour. The surgeon must bear in mind the convexity of the hinder face of the lens, and give to the beak of the scoop a corresponding curved sweep.

It will depend upon the degree of softening which the surface of the lens has undergone, how much pulpy lens-matter will remain behind after the nucleus has been drawn out. As much of this pulp as can be got away without risk of breaking into the vitreous humour should be removed; but provided no solid nodules remain, the surgeon need not be over anxious to get out every particle of soft matter. Each re-introduction of the scoop, tends in some degree to irritate the edges of the corneal wound, and there is always the risk I have adverted to of breaking through with the instrument into the vitreous humour.

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* In his first description of the operation, Graefe advised that the cornea should be incised at its outer edge; but the deformity, and other disadvantages resulting from an over large and misshapen pupil, are better obviated by making the incision upwards.

corneal incision being left clear of any lens-matter, the age may be applied over both eyes, as after flap extrac-

examining the eye for the first time, the surgeon will times find that the whole, or nearly the whole, of the en-d pupil is filled with a flocculent or pulpy mass; but pro- the wound be united, and the cornea clear, this obstruction e pupil need not disquiet him. All will in time become rbed, or if any considerable quantity should eventually re-, it may be cleared away by the aid of two needles, used in manner hereafter described.

most cases the softened periphery of the lens is sufficiently e to be readily seen at the time of the operation; but it metimes so nearly transparent as to be very difficult of de-ion, and it only becomes opaque and strikingly visible two hree days afterwards.

lthough, from what I have said, it will be seen that the two t accidents which attend or follow flap extraction, loss of eous humour and prolapsus iridis, may be evaded by a care-y performed scoop operation, let not the reader suppose that latter mode is to be regarded as 'extraction made easy,' or at success is always to be looked for. Cases occur in which, er the most careful scoop extraction, infiltration and softening the cornea take place; or a more chronic form of irritation ds in permanent opacity of a large portion.

Graefe's scoop operation with iridectomy has undergone everal modifications. One consists in first performing iridec-omy, then waiting till the corneal wound is healed, and the nterior chamber restored; and then, by a second operation, emoving the cataract with the scoop.

Another modification is as follows. A crescentic incision of he cornea is made, and the lens removed, as in ordinary flap xtraction. A forceps being then passed in at the wound, the iris is seized, drawn out, and cut off, just as in the operation for glaucoma; the whole being done while the patient is under chloroform.*

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* As much of the success of the scoop operation depends on the form of the instrument itself, I must bear testimony to the superiority of that invented by Mr. Critchett, to which he has given the name of 'vectis.' (*Ophthalmic Hospital Reports*, iv. 315, 1865.)

MODIFIED FLAP EXTRACTION.

This operation, the latest form of extraction that has nated from the fertile invention of Graefe, has hardly yet acq a settled name. It is frequently called 'modified linear e tion;' but inasmuch as a considerable incision is made i cornea, and the lens is brought out entire, by being p through the wound, the procedure certainly bears more r blance to a flap extraction than either to the 'linear' o 'scoop' modification.

The patient is brought under the influence of chloro the lids are separated with a speculum; and the eyeb steadied by nipping up with a forceps a fold of conju below the cornea. The knife, which is long and very n is made to pierce the sclerotic at about the distance of a of a line from its junction with the upper and outer part cornea, so that the instrument, as it is thrust on, ente anterior chamber quite at its re-entering angle. Havi the point clear into the chamber, the surgeon thrusts it a short distance downwards and inwards, then lowers the into a horizontal position, and brings the point out sclerotic at a spot opposite to that of its entrance; the e the knife, which had been kept upwards, is now to be tu little forwards, and the corneal section completed. The now lies under the still undivided conjunctiva; this is th through with the knife, so as to leave a little flap of the brane loosely covering the wound.

The next step of the operation is to remove the upper the iris with forceps and scissors, to such an extent a seem desirable; then all the anterior capsule is freely la with the cystitome. Next the curette is to be laid up lower part of the cornea, and pressed in a direction u and backwards, so as to induce the upper edge of the present at the section, and as the lens slowly advan egress is to be aided by the curette being steadily upwards, with gentle pressure, over the surface of the c and if portions of the soft periphery of the cataract detached, they are to be helped on in their upward cou repeating the gliding pressure with the curette. To the epithelial surface of the cornea from being abraded e movements of pressure, Graefe advises that the curette ld be made of vulcanite instead of silver.

EXTRACTION THROUGH THE SCLEROTIC.

llude to this operation simply because it is mentioned in s on ophthalmic surgery. Those who first suggested it misled by the apparent advantages of making a wound h would avoid any interference with either the cornea or iris; but they overlooked the far more serious injury the must sustain from a large incision in the sclerotic and roid, extensive loss of vitreous humour, and the introduction struments for seizing and dragging out the lens. The ry of the operation is little more than a history of destroyed ; and those who wish to satisfy themselves on this point refer to the cases quoted by Mackenzie in his *Practical tise* (4th edition, 1854, p. 812).

OPERATIONS ON OPAQUE CAPSULE.

I have elsewhere alluded to the statements of Stellwag and ers respecting the so-called opacities of the capsule (p. 148). rgically speaking, it matters not whether the capsule, which mains in the pupil after various forms of cataract operations, e in its very substance opaque, or whether it be only coated ith opaque material. It obstructs vision, and must be removed.

After the lens has been got rid of by solution, the anterior and posterior portions of the capsule which have been broken through at the centre, retract, and form a white ring, which is often wholly concealed when the iris is in its natural condition, only becoming visible when the pupil has been artificially dilated. Sometimes a band or two may stretch across the pupillary area.

After extraction also, it commonly happens that the shreds of torn capsule form a delicate film, blocking up the pupil; and if any slight degree of iritis has followed the operation, this film may be made additionally dense and visible by exudation of lymph. Even when the area of the pupil looks black and clear, some months after extraction, the surgeon should endeavour to keep the patient in view; for perhaps at the end of a year or so a filmy membrane will be found stretching ac the pupil, so delicate as to be detected only after the clo scrutiny, and with the aid of concentrated light; and yet t existence of this film will just prevent the patient being able t read. Short of this point all objects may be seen well, and y for want of tact and care in detecting this slight obstruction vision, the surgeon may lose the credit and the satisfaction having performed a first-rate operation.

In some instances, the film, which forms many months a extraction, appears to be produced by an opacity of the hy membrane advancing towards the plane of the pupil after lens and its capsule have been removed.

There are no manipulations which demand more judg and care than those for removing capsular obstructions. two chief points to be observed are: to make the apert the capsule central, so that it may correspond to the ax vision; and to avoid isolating any portions by compl detaching them from the rest of the membrane. Loose sh when set floating by unskilful management, are ever afterw a source of annoyance to the patient. Above all, the divisi the capsule is to be made with the least possible disturban the vitreous body.

Every movement of the needle should have a definite ob It is useless to make random stabs and plunges at deta portions of capsule, in the hope of depressing them by lucky hit; for their buoyancy will almost always cause the return to their former position as soon as the needle is drawn. Delicate bands, tightly stretched across the pupil, be divided in the middle, and then each half will retract tow its fixed point, and leave the interval free.

When a single needle is employed to tear through a por of capsule, it sometimes happens that the delicate memb yields and stretches, instead of being torn, and, after attempt, the surgeon is mortified at seeing it return to former position. It is in such cases that it is so efficaciou use two needles at once, as suggested by Bowman.* The hardly any filmy expansion, or hair-like band, that may no this means be divided.

The lids being held apart with a spring speculum, surgeon has both hands at liberty, and he separately intro e needles through the cornea, until their points reach the a of the pupil. He then, according to the nature of the struction, either makes in the centre of the opaque membrane small hole, and then enlarges it by drawing the points of the edles in opposite directions, or cuts, twists, or tears through me band or filament which had been holding together the argins of the pupil.

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* *Medico-Chirurgical Transactions*, 1853, vol. xxxvi. p. 315.

If the rules which I have said should guide the surgeon in fecting the absorption of a cataract be strictly adhered to, amely, to attack the lens at the centre, always working the edle steadily from that point towards the circumference, and o be satisfied with slow progress, without attempting to break p a large mass of lens at the earlier operations; and if he arefully avoids isolating and setting loose any portions of apsule—he will rarely find it necessary to employ any other nstruments than needles for obtaining a perfectly clear pupil.

But if a case has already been unskilfully operated on, and the eedle used roughly and without any settled aim, it may happen that the entire capsule containing some small remains of white lens-matter has become crumpled up and rolled into an opaque mass, which is either moored in the midst of the pupil by two or three delicate bands, or is attached by a single filament, which allows the mass of capsule to float and sway to and fro with every movement of the eye. In such a case the entire mass of capsule must be extracted.

To effect this, an incision of suitable size is to be made through the cornea near its edge, and a forceps introduced, the points being kept closed until they have reached the capsule. This is then seized, and withdrawn by gentle traction, sufficient to make the retaining filaments give way.

The forceps used for this purpose must be so constructed that, when its points are separated, the iris will not fall between them. The cannula-forceps best fulfils this indication.

Far from having described in the foregoing pages all the operations which have hitherto been devised for the removal of cataract, my narrow limits, and still more a distaste for being a mere chronicler of minute differences of procedure, or abortive attempts at originality, have combined to limit my descriptions to those operations which have been approved of and practised by leading surgical authorities, or which have in some degree secured a reputation by retaining for a considerable period the confidence of the profession. A full account of all the cataract operations invented up to the present time, with a criticism of their relative value would form a work almost as large as my present essay. I cannot, however, dismiss this most important subject of cataract without a few observations on the relative merits of the operations which are practised for its cure.

For cataract in children and young persons, solution of the lens by keratonyxis, if performed with the careful precautions mentioned at p. 169, appears to me to be a nearly perfect operation. The natural curve of the cornea is preserved; the pupil remains central; in short, all the structures of the globe are left, practically speaking, in their natural conditions, except that the offending lens is gone. The treatment, it is true, extends over several months, although in infants I have seen all the lens absorbed at the end of a few weeks. But even to a young adult, what is the delay of several months, nay, in extreme cases of enforced caution in operating, what is the delay of a year, when good and lasting sight is eventually gained, compared with the patient's loss, when the surgeon, for the sake of a rapid cure, by his over-manipulation or his dangerous activity, calls up destructive inflammation in the eye he was anxious to save?

Sometimes in the course of the most careful treatment by solution, a sudden disruption and displacement of the whole lens occurs; nothing but an immediate incision of the cornea and removal of the irritating lens-matter, will then save the eye; but this accident seldom happens if proper precautions have been taken from the first.

With regard to extraction, all surgeons, I think, are agreed that, *provided all goes well*, the final result of a good flap operation is superior to that of any other procedure. In an eye where all the tissues are sound except the lens, such an operation skilfully performed, with careful after-treatment until the cure is completed, is a real triumph of surgery, only to be surpassed, perhaps, by the result of an equally perfect operation by solution. But then comes the all-important question, Is all as likely to go well with the ordinary flap extraction as with some of its modifications, or with the scoop operation?

The one great source of trouble after a flap operation is prolapsus iridis. The surgeon may have done his part perfec his last look at the eye, before he puts on the bandage, m show him the iris in its proper position, with the pupil central, and the corneal wound in the closest apposition. For three or ultimately restored by the formation of an artificial

ow that many surgeons, in discussing the perils incident extraction, would put forward, as one of the greatest of danger, the largeness of the corneal wound, as involv- of vitality in the flap or a slow process of opacity in it. lo not think that either of these disasters is often caused mere length of the incision; and, on the other hand, a ening in the cornea allows the lens to escape without g the edges of the wound, and, what is of still more im- e, without leaving behind it any considerable fragments ortical portion. Now this latter circumstance is insepa- om every case in which a lens is forced to squeeze itself ough a small aperture. In doing so it must scrape off r less of its substance, and either these fragments remain, up irritation in the iris, or to insinuate themselves into und, and interfere with its quick union; or else they are d by too much surgical interference, too frequent intro- of a scoop, or a suction-curette, or a syringe, or by too queezing and pressing of the eyeball. Overmuch mani- n of the eye is, I think, the radical fault both of the d flap extraction and of the scoop extraction, and, , of most of the attempted improvements of the flap on.

or loss of vitreous humour, which, without the slightest quite aware how much I am influenced by the fact of my l been accustomed to the constant performance of the l operation for a period of nearly twenty years before any n cation of it was invented. When I tried the scoop operat cases which appeared to be especially suitable for it, I that while the most successful cases left the patient w deformed and enlarged pupil, and with the optical ann of circles of dispersion, inseparable from that condition, in less favourable instances to contend with chronic o insidiously invading the cornea, in patients whom I had se for scoop operation in consequence of feeble reparative p which seemed to render dangerous the larger wound of extraction.

In 1834, a celebrated surgeon of that day wrote an essa *the certainty and safety with which the operation for the ext of a cataract from the human eye may be performed.'* Nine later another surgeon announced '*An easy mode of divid cornea in extraction.*' But in spite of these and other s assurances—which were by no means borne out by the s of the gentlemen who published them—the really expe and candid operator will confess that 'extraction made e still an undiscovered boon.

Every modification which has as yet been devised ha especial difficulty or danger. Only those who have had opportunities of operating, and also of watching the res the operations of others, can attain to a true estimate good and bad points in any given mode of treatment. Pu statistical reports only mislead. To class cataract ope as 'successful' and 'unsuccessful' may please the publ cannot afford real information to the honest and tho practitioner. In general surgery, indeed, many of the m portant operations may be thus abruptly divided. In c ing operations for ovarian disease, for instance, we are that the growth if left to itself will destroy the patient. tumour has been removed, and the patient restored to the operation has been successful. If, in consequence operation for removal, the patient has died, the operati unsuccessful. So with the removal of a malignant grow a crushed limb—of a stone in the bladder, &c., every o appreciate the classification of such cases into 'successfu 'unsuccessful.' But a successful operation for cataract, is it? The mere removal of the opaque lens from the e

down by one man as a success. The recovery of a with such an amount of sight as enables him to guide , is the success of another man. A third is satisfied if ient can read a few large letters; while a fourth, with a standard of excellence, will accept nothing as success f his patients reading fluently a small type, and seeing objects with almost normal distinctness.

n there is the professor who is so overwhelmed with the f his clinique, that he must content himself with doing rations as well as he can, not having the time, even if he e inclination, to follow up his cases, and ascertain for f their ultimate result. Of what value can his statistics

‘pious frauds’ of charity-committees, who hope, by ng reports of successful cases, to attract fresh subscrip- or the good of their institution, are not to be judged by a fic standard. Such appeals are addressed to the general and are of no interest to the profession.

CHAPTER X.

GLAUCOMA.

COMA’ is a term which in process of time has acquired a ng quite different from that originally conveyed by it. g the ancients ‘glaucoma’ signified opacity of the lens, ras therefore regarded by them as a wholly incurable e, inasmuch as to remove the lens from its position have been deemed equivalent to displacing the very seat it. At a later period the etymology of the word caused it applied to many cases of greatly impaired or lost vision led with fixed dilatation of the pupil; for, in such cases, ange of colour which the lens naturally undergoes in old nd some slight diminution of its transparency, combined part to the light reflected from the fundus of the eye a h or drab colour, which, in descriptions, was exaggerated green; and much labour was expended by ophthalmic s, not many years ago, in attempts to explain the cause of -called green or *glaucous* tint. In fact, the dull greyish upon which so much stress was formerly laid, may be

perceived, whenever the pupils are dilated, in the eyes of a
any old person whose lenses are beginning to be cloudy.

The word 'glaucoma' has now come to be used—witho
reference to its etymology, and in a purely arbitrary sen
signify a disease gradually involving the most imp
tissues of the eyeball, and, if left to itself, ending in
blindness.

It is only since Graefe drew special attention to the s
that the important *premonitory symptoms* of glaucoma have
estimated at their true value. Long before his time, the
advanced stage of glaucoma, and especially the strongly m
and unmistakeable outward appearances of the disease i
complete form, were perfectly familiar to the profession;
the connection between this hopeless form of blindness a
earlier stage of inflammatory action was not understood;
the merit of explaining this connection, of showing how i
tably changes, apparently of no extreme urgency, lead the
to incurable loss of sight—above all, the invention of ope
means for arresting these changes, and restoring the ey
usefulness—all this merit belongs to Graefe.

I will first notice the appearances of glaucoma in its comp
stage.

The patients are beyond the middle period of life.

They are usually pale and unhealthy in appearance, o
showing that worn expression which becomes impressed on p
sons who have gone through much suffering.

The eyeball, instead of having the slight degree of elastic
natural to it in health, is remarkably hard, giving to the fin
almost the sensation of a stone.

The sclerotic, often marked with faint dusky patches, is tr
versed by large, purple, tortuous veins, which emerge abrupt
close to the margin of the cornea. Sometimes there is also
slightly-marked vascular zone.

The cornea, although it may be sufficiently transparent
allow of the iris being well seen, presents a peculiar unevenne
of its epithelial surface; so that the lines of a window-fram
instead of being distinctly depicted on the corneal surfac
appear wavy and irregular: and the reflected light is dull, li
that from a slightly steamy glass. In some cases the cornea
hazy throughout its substance, and occasionally the epitheliu
is found vesicated in small patches.

If the state of the cornea allows a good view of the i wo structures will usually be found in close approxima- each other, the pupil being dilated to its fullest extent; mes the pupil is less dilated, but irregular. The change ppearance of the iris is very characteristic. Its sharply- l fibrous character is lost, and it assumes a peculiar olour. Sometimes the veins of the iris are sufficiently ed to be distinctly visible to the naked eye.

lens advances very near to the cornea, and in cases of nding is opaque. Sometimes this opacity has a milky ance, with slight indications of striæ, and the whole lens ull and swollen, as if it had undergone maceration, and bout to burst its capsule. Occasionally the divisions n the planes of lens-fibres are very distinctly seen. The ay vary much in colour, appearing greyish or greenish irty yellow, or dull orange.

eption of objects is wholly lost; sometimes even, all tion of light.

ye may present all the above-mentioned appearances in uence of slow disease, advancing, with intervals of quies- during months or even years; or, on the other hand, the ppearances may be the result of an acute inflammatory coming on in the most sudden manner, and within a ys producing all the changes above noticed, with the ion of the opacity of the lens, which takes place more

inspection of an eye in which glaucoma is complete t enable the surgeon to decide whether the morbid s have been the result of the *chronic* or the *acute* form of ease.

ve already alluded to the merit of Graefe, in having e first to connect that well-known incurable condition eye, to which alone the term glaucoma was formerly l, with a definite train of premonitory symptoms, marking d during which surgical treatment might be of service. peculiar premonitory symptoms consist in intermittent of dimness of sight. A patient perhaps sees well up to ddle of the day, then objects appear as if involved in and reading becomes difficult or impossible. This s may last for the rest of the day, and the next morning have quite passed off, to return again in the course of ours. This intermittent dimness may go on for months, ittle, if any, external appearance of inflammation; in other cases, the onset of dimness is attended with slight ness and watering of the eyes. In fact, unless the pec premonitory symptoms of incipient glaucoma are well un stood, a case of the most serious kind may be lightly rega as one of unimportant catarrhal ophthalmia.

A luminous object, as a candle or a lamp, appears surrou with a halo of prismatic colours. The iris approaches cornea, and the pupil is inactive, although perhaps not dil and, unless the attack be very slight, the surface of the cor instead of presenting a brilliant mirror-like smoothness, appear slightly dull, like a glass that has been breathed up so that the lines of the window-frames will be reflected faint and wavy form. This uneven and dull appearance of corneal epithelium is a very valuable diagnostic mark in stages of glaucomatous disease, and will often arouse suspicions of a careful observer in cases which might other be thought unimportant. It is invariably present in all vanced and confirmed cases of glaucoma. The premonit obscurations may persist for weeks, with occasional inter tions, even for months; and patients may be liable to in mittent attacks for a year or more, before any outburst of ac inflammation occurs. Neuralgia in the ophthalmic division the fifth nerve, is commonly added to the other premonit symptoms.

If the eyeball be carefully examined during any period glaucomatous disease, it will be found in some degree hard than natural. This hardness goes on increasing, until, in th last stage of glaucoma, the globe feels almost like a ball stone.

I know of no instance in which the *tactus eruditus* of th surgeon is more severely tested, than in examining some these incipient cases of glaucoma. The same eyeball ma suggest to two able examiners different degrees of hardness, they may even disagree as to whether the eye be abnormal hard at all.

While the patient gently closes the lids, the surgeon carefully to apply the tips of his fingers upon the upper part the globe, lightly pressing upon its coats. And again, whe the patient opens the lids and looks upwards, the surgeo presses the middle part of the lower tarsus steadily against th sclerotic, just below the cornea, and carefully notes the degr of resistance he meets with. I need hardly say that too gre oftness of the globe is as much a mark of disease as too great ardness, and that, to discriminate truly between the various egrees of what is too hard and what is too soft, the surgeon ust familiarise himself with the exact amount of firmness and lasticity indicative of a sound state of the coats and humours f the globe, by means of that careful fingering which repeated ractice alone can give.

Donders and others have devised formulæ for noting down he amount of tension existing in the globe, but the gradations re so manifold, that it is barely possible to tabulate them orrectly according to any fixed plan.

Rest of the eyes, careful attention to general health, and odide of potassium internally, I have found to constitute the est mode of treatment in this stage; but the patient must be warned as to the true significance of the symptoms, and as to he probable onset eventually of acute glaucoma.

It was to the ophthalmoscopic appearance of the optic nerve and its vessels, in all stages of glaucomatous disease, that Graefe drew such special attention. In well-marked cases the optic nerve appears concave, and the retinal vessels, instead of passing off from their point of emergence in a straight direction, to ramify on the retina, begin by curving over the edge of the cup-like depression at the end of the nerve.* Very slight pressure on the globe with the finger causes visible pulsation in the retinal vessels; or this pulsation may exist without external pressure.

In the slowly-advancing early stage of glaucomatous disease, the depression of the optic nerve may be so trifling as to escape observation; but in confirmed cases it is very marked. When the disease has come to a crisis, and acute glaucoma has set in, the details of the optic nerve and retina cannot be seen with the ophthalmoscope, owing, I believe, in great part to the condition of the corneal surface, which produces irregular refraction of the rays of light. In the advanced stage of glaucoma a dull red glow is sometimes all that can be seen.

As disease goes on, the dimness of sight, instead of being intermittent, becomes permanent, and the field of vision gradually contracts, so that at last the patient in viewing objects seems to be looking at them through a small hole in a scre Sometimes, however, this narrowing of the field of vision d not take place, the dimness being pretty uniformly diffu By this time other marked changes have taken place in globe. It has acquired a peculiar stony hardness; the v on the sclerotic emerge abruptly near the edge of the cornea thick purple trunks; the pupil gradually dilates until in cases the iris almost disappears, acquiring at the same ti peculiar slaty tint. Eventually the veins of the iris enl and are especially noticeable as a ring-like plexus near pupillary margin. The lens at last becomes opaque, mi looking, and indistinctly striated; it is often of a greyish d dirty yellow, or dull orange, and marked with earthy stre and patches. Its threefold division is often very well mark as if by undergoing maceration in water, it had swollen up were about to burst its capsule. By this time even percepti of light is usually quite lost.

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* Plate I. fig. 2. This is a diagram, not a drawing from an individual case. It shows, in a rough way, the abrupt curve of the vessels, the concave form of the optic disk, and the grey tint which the latter sometimes assumes in the very advanced stage of true glaucoma, or of grey atrophy of the optic nerve.

From what I have already stated as to the various chang in glaucoma, it will be understood that it is by a careful comparison and estimate of several morbid appearances take together, that the disease is to be discriminated, and not by the presence of any one distinctive sign. If mere abnormal hardness of the globe be assumed as the proof of glaucomatous change, several forms of inflammation and degeneration quite distinct from glaucoma may be mistaken for that disease. A 'cupped' condition of the optic nerve may simply be the result of chronic wasting. Coloured halos around luminous objects are commonly associated with ordinary catarrhal ophthalmia. But let all these symptoms co-exist;—intermittent obscuration of vision, prismatic halos, fixity of the pupil, increased hardness of the globe, a changed condition of corneal epithelium, cupping of the optic nerve—and the diagnosis becomes an absolute certainty.

I have said that the course of the glaucomatous process is usually more or less gradual, a longer or shorter premonitory stage preceding the onset of an acute attack; but this sometimes comes on suddenly, frequently in the night, the patient having gone to bed apparently well, and being aroused from sleep by intense neuralgic pain to find himself all but blind. When such an attack occurs, on account of the hazy condition of the corneal epithelium, or some change in the vitreous body, or from both causes combined, the optic nerve and retina cannot

ed, and the ophthalmoscope only reveals a dull red
the fundus.

nt of glaucoma.—While cases of chronic glaucoma
advanced to their last stage were abandoned as
urable, and beyond all treatment; those of the acute
r the name of *ophthalmitis interna, ophthalmitis arthri-*
were formerly treated on antiphlogistic principles,
the severest extremes; profuse bleeding, both local
al, and mercury in salivating doses, being the common
ployed to check the progress of disease. Some prac-
egarded gout as the primary cause, and, in addition
n, employed colchicum, or other anti-arthritics.

of every form of treatment, glaucoma remained the
of ophthalmic medicine; and the announcement,
of its curability by means of an operation at once
general attention. In 1857 Graefe* published an
this operation of 'Iridectomy,' and he also brought
t before the Ophthalmological Congress which met at
that year. An incision was to be made through the
se to the sclerotic; a considerable portion of the iris
o be grasped with a forceps, drawn out, and cut off.
peration the 'intraocular pressure,' which was the
l the phenomena of glaucoma, would at once be re-

ration is performed as follows. The globe having been
a forceps, a lance-knife is passed obliquely through
ic, about a line and a half from the spot where it
h the cornea, so as to make a wound penetrating into
r chamber. An iris-forceps is then passed through
, a fold of iris seized, drawn out, and then cut off close
ary attachment. Graefe and others lay particular
n the iris being removed quite up to this point, but I
ieve it to be at all essential. I have always performed
ion with a Beer's knife, making, in fact, a corneal
the upper section for flap extraction, but on a much

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essay in the *Archiv für Ophthalmologie* (vol. iii. p. 456), entitled,
y in Glaucoma, and on the Glaucomatous Process. Also (vol. iv.
, *Farther Clinical Remarks on Glaucoma, Glaucomatous Diseases,*
ative Effects of Iridectomy. These two essays, together with
Coremorphosis as a Remedy in Iritis and Iridochorioiditis, were
der slightly-changed titles, by Mr. J. Windsor, and published by
enham Society (vol. v. 1859).

smaller scale. The wound is a good deal anterior to that reco mended by Graefe, and passes through the true cornea, b close to its sclerotic union. The iris, consequently, is n divided quite up to its ciliary attachment; and yet I have fou the result of the operation just as satisfactory as that first d scribed. In acute glaucoma the lens always advances forwar close up to the cornea, and is therefore endangered by th thrust made with the lance-knife; whereas, in using Beer knife, in the way I have mentioned, its point is always kept i front of the iris as it lies against the projecting lens. It appe to me that if a peripheral portion of iris is removed, sufficient t establish a free communication between the anterior and po terior chambers of the aqueous humour, the object of the opera tion has been attained.*

Hancock has recommended the following operation in gla coma, as being greatly preferable to iridectomy. The point o a cataract-knife is inserted at the lower and outer part of the edge of the cornea, and carried in a direction obliquely downwards, dividing the sclerotic to about the extent of two lines, and penetrating through the corpus ciliare into the vitreous humour. The incision also divides the attachment of the iris, and the delicate fibres constituting the 'ciliary muscle.' The division of these fibres, which I have already spoken of as chiefly constituting the apparatus for changing the form of the lens in the act of accommodation, is regarded by Hancock as the essential point of the operation, since he believes their spasmodic contraction to be the primary cause of the phenomena of glaucoma.

In performing the operation of iridectomy, great care must be taken to avoid wounding the lens, which, as I have said, alway projects towards the cornea, and is sometimes in actual contac with it. This danger is avoided by making the corneal incisio in the way I have recommended.

A good deal of blood usually flows from the cut iris into th

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* If this view be correct, the explanation which those who prefer Ha cock's operation have offered, as accounting for the beneficial effect of ir dectomy, becomes inconclusive. They consider that the unintentional di sion of the fibres of the ciliary muscle, during the performance of Graefe operation, and not the removal of the piece of iris, constitutes its real valu But if iridectomy, performed in the way I have recommended, be found effectual as when the iris is removed quite up to its ciliary attachment, follows that division of the ciliary muscle can in no way contribute to t beneficial result of the operation.

rior chamber, sometimes quite filling it. This blood soon
mes absorbed, if the eye is kept at rest, and bandaged with
refully adjusted amount of pressure, for twenty-four hours.
n, after this period, the eye is examined, the cornea is found
e clear, and the peculiar unevenness of its epithelial surface
given place to the normal mirror-like smoothness.

he recovery of sight after a well-timed and well-performed
ectomy is most remarkable, in many cases almost amounting
he restoration of former good vision; but in other instances
patient is greatly annoyed by the dazzling appearance and
distortion of luminous bodies, the result of the over large
il, and the consequent flooding of the eye with light. Tinted
ses, an opaque diaphragm perforated by a narrow transverse
, either with or without a low-convex glass, or other optical
trivances, must be resorted to according to the circum-
nces of the case. But even if, with all these appliances, the
tient is still annoyed by irregular refraction, this compara-
ely trifling inconvenience is not to be put in comparison with
benefits of iridectomy, without which utter blindness must
vitably have closed the scene.

The precise rationale of iridectomy as a curative means still
nains to be accounted for; and it must so remain until we
ome acquainted with the first origin of glaucoma. We speak,
leed, of the disease as consisting in 'intra-ocular pressure,'
t why the fluid contents of the globe are in excess, so as to
use this pressure, is as yet unexplained. We must be satisfied
ctically to employ iridectomy, without being able to give
y clear theoretical reason for our procedure.

ROFULOUS AND MALIGNANT DEPOSITS WITHIN THE EYEBALL.

As the present treatise on Diseases of the Eye forms part of
general system of surgery, special sections of which describe
e pathology of morbid growths, whether malignant or other-
se, I have not thought it necessary to go into the subject of
ch growths, in connection with the eye, except just so far as
ey have relation to diagnosis and treatment.

Scrofulous and encephaloid deposits, differing so essentially
m each other in their histology, and in the ultimate effects
y produce upon the eye, nevertheless present at a certain
ge of their progress almost the same external appearances.

It is chiefly in infants and young children that encephaloid and scrofulous deposits take place, while melanosis is the form more commonly met with in adults.

In scrofulous and encephaloid cases, the first symptom noticed is a yellowish reflection from behind the pupil, having more or less of a metallic brilliancy, like that seen in a cat's eye. The surgeon will find it difficult to form a decided diagnosis at this early stage of the disease. The pupil for a time retains its mobility, and it will therefore be necessary to apply atropine before using the ophthalmoscope; the employment of which, I need hardly say, is often very difficult with timid or restless children.

The retina will be found thrust forwards as an irregularly lobulated mass, and enlarged vessels will be seen ramifying over the uneven surface. As disease advances, the pupil becomes dilated and fixed, so that the ophthalmoscope can be used without any previous application of atropine. The mass slowly advances until it almost touches the hinder surface of the lens, which, up to this period, retains its transparency. Hitherto the patient suffers little pain, there is hardly a trace of increased vascularity about the conjunctiva or sclerotic, and the general health appears little, if at all, affected.

In the second stage, however, both redness and pain set in. The lens becomes cloudy, so that the deposit at the fundus of the eye can no longer be recognised, except by the indistinct yellowish tint which it transmits through the lens. The sclerotic and conjunctiva become deeply injected, and, so soon as the lens begins to press against the cornea, there is a considerable flow of tears, with intolerance of light. The patient becomes restless and feverish, with loss of appetite and irregular action of the bowels. In this second stage, the eyeball becomes enlarged and the cornea opaque. The sclerotic bulges at one spot, as if matter were forming there, or it becomes soft and fluctuating in several places. Usually the softening is most marked just behind the upper margin of the cornea.

Up to this point it will have been difficult, if not impossible, for the most experienced surgeon to pronounce, with absolute certainty, whether the disease under his observation be scrofulous or encephaloid. In either case the sclerotic usually gives way at the most projecting spot, the humours escape, frequently the lens also, and, for a short period, pain ceases, and the patient's general health improves.

If the case be one of *scrofulous* deposit the disease may now to subside, the globe slowly wasting, until, eventually, a nodule remains at the bottom of the orbit. Indeed, in scrofulous cases the globe does not burst at all; but, g become enlarged to a considerable extent, slowly begins rink, and at last undergoes atrophy. After destroying one scrofulous disease will sometimes attack the other, with ame result.

t should the deposit be *encephaloid*, a farther change now s. A soft vascular growth sprouts forth from the opening e sclerotic, through which the humours of the eye had ed. This fungous mass enlarges with great rapidity, fretly attaining an enormous size, and exudes a profuse fœtid s, which, by exposure to the air, dries into brownish crusts, g to the tumour almost the appearance of a sponge. The ation of one of these crusts, or a very slight touch, often s bleeding from the vessels which traverse the tumour in direction. The patient becomes more emaciated and weak, after several months of suffering, dies, either from repeated f blood, or from the simultaneous development of malignant se in the brain, or some other important organ.

lanosis is the form of malignant disease which attacks the adult life. Sometimes the melanoid deposit is so abundant the whole mass acquires a brownish-black tint; in other nces it is only partially distributed through an encephaloid th. Although more commonly commencing in an eye not ously diseased, melanosis sometimes attacks one which has dy become useless from destructive inflammation.

is between the choroid and retina that melanotic deposit frequently takes place; and the visual power of a portion e retina is often retained to a remarkable degree, while the of it has become completely displaced. The same remark good also in encephaloid cases. The ophthalmoscope is urse our only means for arriving at an accurate diagnosis elanotic deposit within the vitreous chamber. When it has through the coats of the globe, its dark colour and general arance would at once proclaim its real nature. Occasionally nosis appears to originate outside the globe, in connection the conjunctiva, subsequently involving the sclerotic and r tissues.

e medical *treatment* of encephaloid and melanotic deposits in the globe, as in other parts of the body, can be only ative. We may lay it down as a rule in the treatment of such affections, that, while we know of no substance which cure them, they may often be kept in check for a consider time by supporting the general powers of the patient; and more we are able to do this the slower will be the progress the malignant growth, and the less tendency will it evince involve the neighbouring tissues. Strict attention to the patie diet, and to the regulation of his health by means of suit tonic medicines and pure air, will often retard to a remark degree the fatal termination of the disease.

In endeavouring to form an opinion as to the curative resu of *surgical operation* in malignant disease of the eyeball, must altogether dismiss, as untrustworthy, the records of older surgery. For many of the eyes said to have been remo without any return of disease were doubtless affected scrofulous deposit, which, as I have said, at a certain stage its progress, so closely resembles the encephaloid form. Remo of the eyeball should be undertaken only after the most care examination, both local and general. The surgeon should inqui into the mode in which the various bodily functions are performed, so as to assure himself that no appreciable deposit of malignant kind has taken place in any of the viscera. He must, as far as possible, ascertain that the encephaloid or melanotic mass is fairly enclosed within the fibrous case of the eye, without having involved the optic nerve, or penetrated through the sclerotic into the cavity of orbit. These conditions cannot be absolutely determined; but attention to certain points will help the surgeon to make some approximation towards a correct diagnosis. If the eyeball be thrust forwards, without its actual volume being increased—if it be habitually turned in any particular direction—if it be fixed, or only movable to a very slight degree—above all, if the point of the little finger passed backwards by the side of the globe, encounters any resisting mass within the orbit, it may fairly be assumed that the morbi deposit extends beyond the cavity of the eyeball; and in such case its removal would be of doubtful success. Even under th most favourable circumstances the surgeon, when convinced o the existence of a malignant growth, would give a most guarde prognosis; for in no class of operations for the removal of suc disease are the statistics more discouraging than in thos relating to the eye.

CHAPTER XI.

DISEASES OF THE LACRYMAL APPARATUS.

lacrymal apparatus comprises the lacrymal gland, which tes the tears—the puncta and canaliculi, which convey into the lacrymal sac, where they temporarily accumu- –and the lacrymo-nasal canal, whereby they are finally yed into the lower chamber of the nose.

we consider the small calibre of the canaliculi we can ly understand that a very slight degree of thickening in elicate membrane which lines them, or a trifling displace- of the puncta, can suffice to disarrange the mechanism of g up and carrying on the tears; and accordingly we find watering of the eye (*epiphora*) is a frequent symptom in us forms of conjunctival inflammation. It also constitutes self a troublesome condition, which is constantly being ght under the surgeon's notice.

the puncta are quite impervious, of course the tears must le down the cheek as fast as they are secreted. A con- ion or stricture of the puncta or canaliculi will cause a less lete overflow. If the lacrymo-nasal canal be strictured, or tlet obstructed, the tears passing into the sac will accumu- here, and, together with the pent-up mucus, form a swelling ed *mucocele.* Unless relief is obtained, the distended sac nes inflamed, and pus is formed, which eventually dis- ges itself through an opening in the skin, constituting true *a lacrymalis.* This term, however, is often incorrectly ap- to abscess of the sac without any perforation of the skin.

hen a case comes before us in which there is a continual ry state of the eye, our attention should be at once directed e puncta. These apertures, in a healthy state, are in con- with the ocular conjunctiva, so that, to bring them into it is necessary to draw the margin of the tarsus a little from the eyeball. If the conjunctiva lining the lower lid ecome considerably thickened from chronic inflammation, dge of the tarsus may be so much everted as to cause the tum to face upwards, or even directly forwards. In such a ion it can no longer take up the tears, which accordingly ver the edge of the lid. In extreme cases of *lippitudo* and

chronic ophthalmia, the puncta, still retaining their nat
position, are sometimes found to be so completely oblitera
that their position can no longer be detected.

If the puncta are in their natural position, and their openi
appear unobstructed, and yet no tears can be made to regur
tate through them when the point of the finger is firmly pre
against the lacrymal sac, just below the tendon of the orbic
laris palpebrarum, we may suspect some stricture to exist in
canaliculi. We can ascertain this only by exploring them
a fine probe. This may seem to be a very simple matter;
it requires considerable care and tact, without which
serious mischief may result. The membrane lining the ca
is extremely delicate, and any want of gentleness in passing
probe may tear the membrane, and so give rise to fresh obstr
tion. We must bear in mind the abrupt turn which the ca
makes at a short distance from the punctum. In passing
probe into the lower canaliculus, the instrument should
directed almost vertically downwards for about half a line,
then turned inwards towards the nose, in which direction it
pass on, should no stricture exist, until its point strikes aga
the inner wall of the sac, where it lies against the bone. Dur
the whole process of introducing the probe, the tarsi should
kept on the stretch, by drawing outwards the external canth

Except to a practised hand, it is often difficult to dete
whether the point of the probe is arrested close to the junct
of the canaliculus with the external wall of the sac, or whe
the point has reached the internal wall. In the former ca
any onward pressure with the instrument produces a slig
dragging of the tarsus; whereas contact of the probe with
inner wall of the sac not only conveys to the hand a pecul
feeling of firm resistance, but at once causes all movement
the tarsus to cease.

If the canaliculi be found free from stricture, and the
forms a distinct prominence below the inner canthus, it
pretty certain there is an obstruction at the lacrymo-na
canal. If this canal be perfectly closed, while the canalic
are free, firm pressure of the finger on the swollen sac
cause its contents to escape at the puncta; but if the ca
although narrowed, be pervious, steady pressure in a direct
downwards and a little backwards, may overcome the resista
of the stricture; the swelling then suddenly yields, and the c
tents of the sac pass into the nose.

en we consider that the membrane lining the outlet of the o-nasal canal is that common to the chambers of the nose, not be surprised that catarrhal inflammation of this mem-hould be a frequent cause of lacrymal obstruction. If pres-a the sac suffices to empty its contents into the nostril, the enience of the partial obstruction at the outlet may be a check by the patient taking care frequently to make this re, and to use at the same time other means for restoring ing membrane of the sac as well as that of the nose to a healthy condition. But if this pressure is omitted, and ars and mucus are allowed to collect and to distend the is distension, under some attack of catarrhal inflamma-nay suddenly transform the chronic disease into an acute Pain is then felt in the part; the lids become red and —sometimes assuming an erysipelatous appearance; and tient is quite unable to separate the tarsi. The swollen els hard to the touch, and even slight pressure on it is nely painful, while it fails to press out any thing from the k.

se symptoms show that suppuration is taking place within :. If the case is left to itself, the pus escapes by bursting h the skin, and the opening frequently remains fistulous, ng the tears, which have passed through the puncta into :, to trickle out upon the cheek, thus constituting a true *lacrymalis.* After all inflammation has passed away, and dness and swelling which attended the formation of the s have disappeared, the fistula often contracts to such l aperture, that, were it not for the tears which slowly rom it, the opening would hardly be perceptible. It is the size of a pin-hole, and almost resembles one of the in minuteness of aperture.

tment of lacrymal obstructions.—These obstructions, varying y do from a slight thickening of some portion of the lining rane of the sac or nasal canal, causing occasional watering eye, up to a total occlusion of the nasal canal, with dis-nent or stricture of the puncta and canaliculi, cannot of all require the same kind of treatment. Slight cases of ning of the lining membrane of the sac, if of recent date, e much benefited by the repeated application of small listers, about half an inch long, over the sac. Astringent ons of alum or tannin may, at the same time, be dropped he corner of the eye, so that they may follow the course of

the tears, and thus reach the thickened membrane. This o
may be facilitated by slitting up the canaliculus in the ma
hereafter to be described. Each time the drops are used
sac should be previously emptied, by pressing the point o
finger upon it in a downward direction. Should the l
membrane of the nose be in a thickened state, injectio
astringent lotions into the nostril are of service; and in all
attention to the general health and suitable tonic medi
are indicated.

Warm water-dressing should be applied whenever
inflammation of the sac sets in with the symptoms I
described. This form of applying warmth and moisture
all affections of the lids and parts about the eye, to be pref
to poultices, as the latter frequently produce a troublesome
of eczematous eruption. Diligent application of water-dre
for four-and-twenty hours will frequently subdue acute inf
mation of the sac to such an extent that not only do the
ness and swelling of the lids disappear, but the thickeni
the internal membrane gives way; so that gentle pressure
the sac suffices to empty its contents into the nose, and the
returns to its chronic condition. Should this not be the
an incision must be made into the sac, and exit given t
pus.

There is hardly any form of local disease which has give
to a greater variety of surgical treatment than chronic diste
of the lacrymal sac, and stricture of its nasal duct. Th
tended sac has been compressed by an apparatus of pad
justed by means of springs and screws. The strictured
duct has been subjected to gradual dilatation by means of s
of catgut, introduced through an opening made into th
and brought out into the nostril; strings of increasing thic
being used as the canal would admit of their passage. Dila
of the stricture was at one time attempted from below, by
of curved sounds, introduced into the sac from the nostri
these instruments were difficult to introduce, there was
risk of breaking with them some of the fragile bones
neighbourhood of the nasal duct, and they could not re
stricture situated high up towards the entrance of the can
At one time metal tubes were placed in the cavity of th
which were intended to be healed in, and permanently to
its cavity; but Nature, disliking foreign bodies, even
introduced by a surgeon, always rebelled against them, a

best to dislodge them, either upwards or downwards. The maintained its ground longest, and until recently formed *ultima ratio* in every case of obstinate lacrymal obstruction. made long enough to reach from just below the tendon he orbicularis palpebrarum, where an incision was made into avity of the sac to admit it, to near the floor of the nostril. upper end was furnished with a nail-like head, to support style in its proper position; and it was intended that the s, entering by the puncta and canaliculi, should come into act with the piece of metal, and glide down by the side of nto the nose. The style was to be taken out every day, sed and replaced; and at first the cure appeared perfect; patients, from timidity, awkwardness, or carelessness, neg- d this precaution, the instrument was seldom, in some never, removed, and eventually it became encrusted with y deposit from the tears, or was consumed by oxydation; skin around the nail-shaped head was drawn in, and at ame time blackened with the sulphuret of silver,—in short, style, so highly praised at first, became at last a source of yance and disappointment.

bout eighteen years ago, Bowman* suggested a very simple useful operation, which, in many instances, suffices to *epiphora* resulting from contraction or displacement of the cta, while at the same time it affords a ready access to any ruction that may exist in the course of the sac or lacrymo- l canal.

uppose that, in consequence of chronic ophthalmia, or from other cause, the lower punctum has become displaced, hat, instead of facing towards the eyeball, it is directed ards and forwards; the tears in such a case will run over edge of the lid; and the object of the surgeon must be to sfer, as it were, the displaced punctum to a position where an catch the tears before they overflow the border of the us. The lid being put upon the stretch, a fine grooved ctor, or, in default of that, an ordinary punctum-probe, is passed along the whole course of the canaliculus, and held ly there, while a fine sharp-pointed knife is run along the e, as far as the caruncle, so as completely to lay open the al, and thus extend its orifice backwards to the point where tears accumulate. A very handy little knife, with a slightly bulbous point, has been invented, with which the canali can be slit up without the use of any probe or director.

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* *Medico-Chirurgical Transactions* for 1851, p. 338.

For several days after the incision has been made th the upper wall of the canaliculus a probe must be passed its track, to prevent the lips of the wound growing tog In some persons it may be necessary to use the probe f days or more; in other cases there is hardly any disposit the edges of the wound to unite.

When the overflow of tears depends simply on faulty po of the punctum, this laying open of the canaliculus m itself effect a cure. In cases of obstruction in the lacrym or its nasal duct, the incision affords an easy access to th of stricture.

Occasionally, however, another complication exists narrowing of the canaliculus just at its point of communic with the sac, which may prevent the passage of a prob ficiently large to act upon the stricture. In such a case a straight cannula, containing a lancet-shaped point, which be protruded or withdrawn by means of a spring,—in Stafford's instrument for dividing urethral stricture, made miniature scale,—must be carried along the canaliculus, employed upon the constricted spot.

The probes for dilating strictures in the sac or its canal be of various degrees of thickness, but all sufficiently stro sustain the requisite amount of pressure without bending. are best introduced by the surgeon standing behind patient; and it will be found advisable to avoid using tho too small a size, as they are of course more likely than tho a larger size to catch in a fold of membrane, or even to pierc membrane covering the bony walls of the canal.

The tarsus being put on the stretch, the probe is passed the newly-opened canaliculus until its extremity strikes ag the inner wall of the sac. Still keeping its extremity in tact with this part, the probe is raised to a vertical position, then carefully carried downwards to the seat of stricture. canal inclines somewhat backwards, and this inclination be carefully borne in mind. The surgeon must feel his with the point of the instrument, and be on his guard ag using unnecessary force. In cases of old dilatation of the its relaxed lining membrane readily catches in a fold agains point of the probe, and the surgeon must learn to discrimi between a check arising from this cause, and the obs

h difficulty in passing the instrument, the membrane
swollen, and will allow the contents of the sac to pass
the swelling has been relieved by fomentation.

d rules can be laid down as to the frequency with
e probe is to be used, nor as to the length of time
for a cure. This will vary from a few weeks to several
nd relapses frequently occur long after the stricture
o have been completely overcome. Too frequent use
be will set up irritation, and induce a more abundant
ulent secretion. When this takes place, the probe
laid aside for a week or two, and fomentation, with
ssing at night, be substituted.

the whole course of treatment by means of the probes,
nt must never neglect several times a day to press out
nts of the sac, endeavouring to do this in a downward
; or, if this cannot be effected, by pressure through the

who are about to treat a case of long-standing lacrymal
on by the passage of probes, should clearly understand
h care, tact, and patience such an undertaking requires.
quence of the minuteness and delicacy of the parts con-
ne treatment of a stricture in the lacrymo-nasal duct
even greater care and skill than that of a stricture in
ra; and I am sure that those who have seen much
will bear me out in asserting that by far the greater

inflammation, is sure to increase instead of lessening the
of stricture.

Even when all possible care and skill have been employe
treatment of stricture in the lacrymal passages, by the
just described, is often extremely tedious; for the affectio
be complicated with great dilatation of the sac, caries
adjacent bones, or false passages of various kinds, resultin
previous mismanagement.

Dacryolithes.—This term has been applied to certain
tions which are sometimes met with in the lacrymal p
in the canaliculi, or in the sac, caused by the earthy s
tained in the tears becoming deposited in the form of a
Watering of the eye, repeated attacks of inflammatio
sac, or swelling and suppuration about the canaliculus,
when the part is pressed upon, are the more obvious sy
A probe carefully passed into the canaliculus, or throug
the sac, would detect the presence of the concretio
must be cut upon, and extracted with a scoop or othe
ment.

Irritation of the lacrymal passages is sometimes c
the intrusion of a detached eyelash into one of the c
In this curious accident the hair enters at the punc
passes on as far as the abrupt bend which the canal
about a line's distance from the orifice. Here it is arr
point protruding to a greater or less extent, and irrit
caruncle and semilunar fold. The symptoms induced a
ing and itching about the inner canthus, with red
the neighbouring conjunctiva. If the hair be short,
will protrude so little as to make it very difficult of d
on its withdrawal, all irritation at once ceases.

DISEASES OF THE LACRYMAL GLAND AND ITS DU

The works of foreign writers present a formidabl
diseases affecting this gland, almost every form of a
chronic inflammation, and enlargements, both simple a
nant, being recorded; while our own countrymen appe
met with but few cases of the kind. My own experien
lead me to believe that compared with the other glandu
tures of the body, the lacrymal gland is very rarely th

d, without attention being paid to the after-treatment
ase, the opening is apt to become fistulous (*dacryops*
), the lacrymal secretion continuing to distil through a
perture in the skin. Such a case may be treated on
principle as a fistula of the parotid gland, namely, by
in at the opening a thread, which, having been carried
the thickness of the lid, and brought out at its con-
surface, has a small knot made at one end. This knot
rawn into the fistula, and, by continued traction of the
d, is made to ulcerate its way through the conjunctival
The tears being thus diverted, the fistulous orifice in
may be closed by paring and uniting its edges.*

d the lacrymal gland really become the seat of malignant
or should it be deemed advisable to extirpate it on
of chronic enlargement, or for any other cause, the
n would be a simple one, and would offer nothing worthy
k.

only instances, three in number, where I have myself
ed the gland, it was not the seat of disease, but was
to do away with the inconvenience of the overflow of
e puncta and canaliculi having been wholly destroyed by
e burns. In one of these cases an artificial pupil I had
uld have been rendered almost useless, in consequence
ooding of the eye with tears, had their secretion been
to continue.†

CHAPTER XII.

DISEASES OF THE EYELIDS.

So many various tissues enter into the formation of the ey lids that they must necessarily be liable to a great variety diseases; but it would be absurd to attempt a description of the morbid conditions which they share with the other porti of the common integument of the body.

The *orbicularis palpebrarum* is subject to a spasmodic twit ing of some of its fibres, usually those of the lower lid, prod ing a visible quivering of the skin, popularly termed the ‘ blood.’ To persons of an irritable nervous system this becom teasing from its frequent recurrence. It is commonly the re of intestinal irritation, especially that produced by ascarid and a few doses of purgative medicine, followed up by toni usually suffice to put an end to the annoyance.

Epicanthus is a term applied to a slight deformity, someti observed in children, consisting in a crescentic fold of redund skin at the inner corner of each eye, partly or wholly concealing the caruncle. It is associated with a depressed form of the na bones, and if, in after life, the bridge of the nose becomes mo prominent, the fold of skin, to a certain extent, diminishes, although it never wholly disappears. *Epicanthus* imparts to the face an unpleasant, Chinese expression; and the only cure is by pinching up and removing a vertical fold of skin on the media plane, just between the eyebrows, and then bringing the woun accurately together.

Ptosis, or drooping of the upper lid, may exist in various degrees, producing merely a slight deformity, or becoming complete, so as wholly to obstruct vision. It will be spoken of under ‘paralysis of the third nerve.’ In some cases of congenital drooping of the lids it is possible that the levator palpebræ muscle may be altogether wanting. Patients with this defect have no power of moving the lids except by calling into action the occipito-frontalis muscle. The lids do not present that transverse fold in the skin, which, in the normal state, corresponds to the upper part of the eyeball, but are smooth and unwrinkled from the eyebrow to the tarsus, while the forehead is furrowed by the frequent action of the occipito-frontalis.

he terms *Entropion* and *Ectropion* are respectively applied to inversion and eversion of the margins of the lids.

he simplest form of *entropion* is that which is occasionally with in children, the subjects of irritable ophthalmia, as a lt of spasm of the orbicularis palpebrarum. Extreme intoler- e of light induces this muscle to contract so often and so bly that at last the lower tarsus rolls over against the globe, ing an inversion of the eyelashes, which greatly adds to the nt's distress. Contractile collodion, painted on the skin of lower lid, draws the part into a proper position, and keeps o while suitable remedies are being employed to subdue the inal disease.

similar spasmodic inversion of the lower lid happens to old ons, in whom the skin is relaxed and the tarsus flaccid. The cular contraction is repeated until at last the lid becomes olled upon itself, that both the cilia and the tarsus are com- ely hidden, and the border of the lid appears to be formed of mon integument. In these cases of extreme inversion the itation is really much less than when the inversion exists to a t degree. For in the latter case the points of the cilia are ght into direct contact with the ocular conjunctiva, while in former case the tarsus rolls over so completely, that the points the cilia become buried in the fold of palpebral conjunctiva, d consequently do not come into contact with the globe at all.

A far more severe and obstinate kind of entropion is that which follows chronic inflammation of the palpebral conjunctiva, especially neglected or maltreated purulent ophthalmia. The pper tarsal cartilage becomes so much curved upon itself, that the whole range of eyelashes turns backwards against the globe. This curving of the tarsus is often aggravated by the long-continued application of solid nitrate of silver and sulphate of copper to a granular conjunctiva. If in such cases we evert the lid, we find a pale smooth cicatrix occupying its deep concavity. Partial or complete inversion of the margin of the lids may also result from contraction of the conjunctiva, following injury from acids, caustic alkalies, or burns.

A great variety of operations has been devised for the cure of entropion. In that form, so common in old persons, where the inversion is owing to contraction of the orbicularis muscle acting upon a flaccid lid, a cure can usually be effected by removing an elliptical portion of the skin of the lid, together with the subjacent fasciculus of muscle, and then accurately uniting the wound with fine sutures. It requires care exa to calculate what quantity of skin should be taken away; a of course the removal of too large a portion would ca eversion of the lid, and so produce a deformity of the oppo kind.

If the tarsal cartilage be so much curved that removal of sk is insufficient to draw the eyelashes away from the glob recourse may be had to an expedient suggested by Streatfeil The skin of the lid being carefully dissected up, sufficiently expose the convex surface of the tarsal cartilage, a long narr wedge-shaped slice is cut out from this, so as to form a groo extending the whole length of the tarsus. The curved cartil thus becomes bent backwards, as it were, and the skin bei restored to its position, is united along the cut edges with a fe fine sutures.

Should all these plans fail, and the eyelashes still irritate th globe, the whole row must be dissected off, together with th portion of the tarsal margin in which their roots are imbedded.

Ectropion, or eversion of the lids, may exist in the most various degrees. Its worst form is seen as a result of burns of the face, followed by extensive contraction of the cicatrices.

A spasmodic form of ectropion is often seen in purulent ophthalmia of infants, and in scrofulous and irritable ophthalmia of older children. In infants the unsightly appearance of the bright red and swollen conjunctiva gives rise to great alarm in those who have the care of the child; but they may be assured that as the inflammation subsides, the deformity will gradually cease.

The chronic forms of *ectropion* in adults, which are produce by granular thickening of the conjunctiva after purule ophthalmia, or by the contraction of cicatrices in the ski surrounding the palpebral aperture, the result of ulcers, burn exfoliation of bone, &c., require a variety of operations, accor ing to the special nature of the case.

When, after chronic ophthalmia, the everted conjunctiva the lower lid presents a thick mass of granular excrescenc without any material elongation of the tarsus, or disease of t neighbouring skin, a cure may sometimes be effected by moving with scissors the greater portion of the palpeb conjunctiva, and then uniting the edges of the wound w very fine sutures. These may be left to ulcerate out by the selves, the lid being kept in proper position by the aid of a nt laid along the margin of the tarsus, and fixed by means everal layers of lint saturated with collodion. In this way lids are kept in contact with each other, and the apparatus not be disturbed for several days. When the wound in palpebral conjunctiva is closed, the loose stitches may be oved, and the pad of lint replaced until the cure is complete. very old and severe cases of ectropion, the tarsus becomes uch stretched, that, in addition to the removal of con-ctiva, it is necessary to take away a wedge-shaped portion the elongated lid itself. Still worse cases, such as those lting from burns or disease of bone, may require the forma- of a new eyelid by the transplantation of a portion of cent healthy skin.

Trichiasis consists in an irregular growth of the eyelashes, general form of the tarsus itself not being changed. ea ciliaris very commonly causes trichiasis, by inducing atrisation about the roots of the cilia. Sometimes three or r fine eyelashes present their points towards the globe, or n a single hair will grow in this direction, all the other hairs intaining their natural position.

Trichiasis, when existing only to a slight extent, causes constant annoyance to the patient, by a sense of pricking, and by the constantly irritable and watery state of the eye which it induces. If only a few hairs grow irregularly, the removal of the entire tarsal margin need not be resorted to. The offending hairs must be carefully plucked out from time to time; or if they form a little group, they may be removed by dissecting out the small portion of lid external to the tarsus itself, in which their roots are implanted, and then uniting the wound with a suture.

To draw out an eyelash by the root seems a very simple and trifling matter; and yet there are few surgical manipulations in which care and the skilful use of a well-made instrument are so necessary. The cilia-forceps one commonly meets with are liable to cut the hair instead of merely grasping it firmly; and the stiff broken stump of a hair causes far more distress to the patient than its natural fine point. The hair should never be sharply jerked out, but removed with a slow steady pull.

INFLAMMATION OF THE LIDS.

The eyelids are of course liable to the various forms of inflammation which attack similar tissues in other parts of the body.

A few inflammatory affections of the lids seem to demand notice on account of their presenting peculiarities of appearance, or being distinguished by special names.

A *stye* (*hordeolum*) is in fact a minute boil. It begins at the very edge of the lid, as a small, red, tense swelling, and at first is merely troublesome by the itching and sense of stiffness it occasions. As the inflammation goes on, the redness and swelling may more or less involve the whole lid, so that the eye becomes completely closed. In a few days matter forms, and shows itself at the summit of the stye; the cuticle gives way, pus and a small slough of areolar tissue escape; and then the redness and swelling subside, and the lid soon assumes its former appearance.

Scrofulous and delicate children are the usual subjects of styes, and they are comparatively rare in adults. Attention to the state of the bowels, carefully regulated diet, and the use of tonics, comprise the general treatment. Locally, warm water-dressings are greatly to be prefered to poultices, which are apt to irritate the skin. The stye should never be rubbed or squeezed; and no incision is necessary, except perhaps, a slight puncture through the cuticle when the pus is pointing.

Abscess sometimes occurs in the Meibomian follicles. These organs pour out upon the edges of the lids a greasy secretion, which prevents the tears running over, and causes them to flow onwards to the puncta. Sometimes a follicle becomes obstructed at the orifice, and the retained secretion forms a minute solid granule, looking, when extracted, like a little grain of sand. If it projects sufficiently to touch the globe, a slight irritation is produced until the granule is removed.

If, however, the solidified secretion cannot in this way escape through the orifice of the follicle, it causes irritation, and at last a small abscess in the follicle itself. The lower lid is commonly the seat of these abscesses. They commence with a small patch of vascularity in the palpebral conjunctiva, a short distance from the free border of the tarsus, and gradually a yellow dot of pus forms in the centre of the vascular patch. If the conjunctiva at this point be punctured with a lancet, and a small scoop be introduced, the cause of the suppuration, a little nodule of stearine, about the size of a poppy-seed, may usually be turned out, and then all irritation subsides.

nea ciliaris,—termed also *ophthalmia tarsi*, *psorophthalmia*, *palpebrarum*, &c.,—is one of the most common and blesome diseases of the lids. It is too often neglected ng the early stage, when alone it is really curable, and the eon is probably consulted for the first time when many of hair-bulbs have already been irreparably destroyed, and the ining hairs are misplaced and inverted, constituting the called *trichiasis*. This term is frequently employed as if nymous with entropion, but it ought properly to be ricted to mean displacement of the *hairs* themselves, while opion signifies a turning-in of the *lid*.

inea ciliaris is seldom seen in its early pustular form; for little pustules at the roots of the eyelashes soon break, and discharge exuded from them dries into crusts, which cling at the hairs, matting them together, and sometimes almost ealing them from view. Tinea ciliaris, if allowed to go on hecked, gradually destroys the tissues which secrete the s; and when the disease has thus exhausted itself, and the crusts have fallen off, the tarsi, instead of presenting ply-beveled edges, appear rounded off, the skin and con- tiva being gradually blended together into one smooth, red, ing cicatrix, in which neither cilia nor Meibomian orifices be traced. Very often the puncta also become obliterated, the tears consequently run over the cheeks, causing irrita- ty and blinking of the lids. This is the condition to which term *lippitudo* should be restricted; *tinea ciliaris* being erstood to mean that state in which active disease at the t of the eyelashes is still going on.

n the *treatment* of tinea ciliaris, the chief difficulty arises m the age of the patients. Daily attention is required, to vent the accumulation of crusts, which should be carefully hed off night and morning. Patients often derive but little efit from the remedies prescribed, in consequence of this ular cleansing being neglected. It is useless to apply oint- nts any where except upon the very surface of the minute s at the roots of the hairs; and if the latter are kept closely with scissors, the application of ointments, and the pre- tion of crusts, are greatly facilitated. Of course, this cutting he eyelashes requires to be done by the surgeon himself, and ointment should be neatly applied with a pencil. When s cannot be thoroughly looked after, it is perhaps better rescribe lotions, as they can hardly fail to reach the seat of disease. Ung. hydr. nitratis, ung. hydr. nitrico-oxydi, and ung. zinci oxydi, sufficiently diluted with ung. cetacei, or fresh lard, are the best ointments. The acetate of lead may be used as a lotion, in the proportion of from two to four grains in the ounce of distilled water.

The worst forms of lippitudo may often be greatly relieved by slitting up the canaliculi in the manner described at page 227. By this means the overflow of tears is checked, and this of itself is an immense comfort to the patient; while, at the same time the tendency to ectropion, which long-continued lippitudo often induces, is considerably diminished.

Phtheiriasis.—Among the irritable conditions of the eyelids, I may here notice that arising from the presence of lice. These creatures are 'crab-lice' (*phthirius*), a species quite distinct from that which infests the scalp (*pediculus*). They thrust their heads into the skin at the roots of the cilia, and by means of the sharp claws with which all their legs, except the first pair, are provided, hold on so firmly, that they cannot be dislodged without great difficulty.

Phtheiriasis of the eyelids is an extremely rare affection, at least in this country, and I have met with only three or four instances, all of which occurred in children. On superficial examination, the cases are very similar to those of tinea ciliaris. The eyelashes present a powdery appearance, and their roots seem to be clogged with yellowish-gray and brown crusts; but by careful scrutiny of these supposed crusts, the movements of the insects may be detected; and the powdery appearance of the cilia is owing to their being clogged with the exuviæ of the creatures, and dried sanies from the wounds they have inflicted. The insects may speedily be destroyed by thoroughly smearing into the roots of the eyelashes the white precipitate ointment (ung. hydrarg. ammonio-chloridi).

MORBID GROWTHS OF THE LIDS.

The following are the more common swellings which appear in or upon the lids.

Cysts, of two distinct kinds. Those of the first kind, extremely common, are met with both in the upper and the lower lid (*Encysted tarsal tumour*, Tyrrell; *Chalazion*, Mackenzie); the others are found almost invariably at one spot, namely, just over th

al angular process of the frontal bone, to the periosteum
ch they are attached.

luscum is met with on the lids of children, and seems iden-
rith the little masses termed by Tyrrell 'glandiform,' and
ckenzie 'albuminous' tumours.

rts are sometimes found on the lids, differing in no respect
those on other parts of the body.

vi materni, resembling those of other parts.

Cysts of the lids are met with at all ages. They may exist
y, or several may appear together, coming successively to
full growth. The skin over them is quite unchanged, so
when small, they are hardly recognisable except by the
. They feel like half a hemp-seed or half a pea fixed by
at side to the tarsal cartilage, and presenting a convexity
ds the skin, which may be freely moved over them. They
exceed the size of a pea, except when suppuration has
place within them.

he lid be everted, the position of the cyst is recognised by
ning of the tarsal cartilage, forming a dusky spot, around
the conjunctiva is reddened. These cysts may remain of
lerate size during life, without causing any inconvenience;
metimes they suddenly inflame and become enlarged, the
ver them reddens and at last gives way, a small quantity
s escapes, and afterwards a thin sanies continues to ooze
the aperture. But more commonly the pus makes its way
gh the palpebral conjunctiva, and then a little red fungous
gradually protrudes, which, by the continual pressure of
reball, becomes flattened out into a mushroom shape.

ien these cysts are so small as to escape ordinary obser-
, they require no treatment; but if they become so large
be unsightly, and, still more, if they inflame and suppurate,
must be treated in the following way. The lid being
ed, a crucial wound is made through the conjunctiva into
avity of the cyst. If the inflammation has been acute, pus
es, otherwise a little serum. A scooped probe passed into
avity, and twirled about in various directions, brings out
ccumulated epithelium, which has a jelly-like appearance.
d then fills the cyst, and makes it as large as it was before
ncision. The patient, however, may be assured that this
ling will gradually subside. To prevent premature closing
he wound, and refilling of the cyst, the probe should be
in the way just described every third day for about a

touched with nitrate of silver; or they may be tied at the
with a fine silk, and allowed to slough.

Nævi of the lids differ in no respect from those met with in
parts of the body; but they require more careful and dis-
nating treatment, on account of the importance of avoiding
ch as possible, any considerable loss of skin; a large
ix being not only in itself unsightly, but likely, by its
action, to cause distortion of the lid. Subcutaneous liga-
, therefore, or the introduction of probes coated with fused
te of silver, must be preferred to including any portions
kin within a ligature, or extensively destroying it with
arotics.

have seen injections of alum cause sloughing of the lids and
t subsequent deformity; and such a result might follow the
ction of any similar fluid into the loose areolar tissue of the
, unless some contrivance can be used to restrain the fluid
hin proper limits.

n the following case an injection of tannin proved successful.

young lady was brought to me with a nævus on the upper lid, the size of a
hazel-nut. I was informed it had already been twice operated on by the
duction of threads steeped in nitric acid, and much inflammation and
ghing had ensued, as was proved by a considerable cicatrix of the skin near
outer canthus. The apex of the swelling was on the free margin of the lid,
verting which, a small bunch of veins, about the size of a barley-corn, was
projecting through the tarsal cartilage, only covered by conjunctiva. The
us seemed to be formed almost wholly by veins, the larger trunks of which
ld be felt through the skin, as they emerged below the superciliary ridge.

aving enclosed the whole upper lid in a 'ring forceps,' I could completely
ate the nævus from its parent veins, and I then punctured it with a very
ll narrow knife (Hays's needle-knife), and cut up its tissue subcutaneously.
ng emptied of its blood, the nævus collapsed; and I next, with a fine syringe,
w in a few drops of a saturated solution of tannic acid. After a short pause,
laxed the pressure of the ring forceps, and so allowed the returning blood
ingle with the injected fluid.

The subsequent inflammation produced a good deal of swelling and hardness
the lid; but the only slough was a mass about the size of a small pea, which
de its way out at the little wound. The final result was complete oblitera-
n of the nævus.

Carcinoma rarely commences in the lids, although it may
read to them from other parts. Should it be already far
vanced when first brought under the surgeon's notice, extir-
tion would hardly be attempted. Small, hard, suspicious
owths at the margin of the tarsus may be removed by

excising a wedge-shaped portion of the lid on which they and then uniting the wound with sutures.

Epithelial cancer chiefly attacks the skin over the lacry sac, and from that point extends over the nasal and supe maxillary bones, having the appearance of a shallow pale with an irregular outline and uneven borders, and with scarcely perceptible quantity of secretion. Chloride of made into a paste, and applied over the entire surface of the so as to include its edges, will sometimes very effectually troy the morbid growth, and it may be reapplied whenever part of the border of the sore begins to exhibit fresh acti Of course, the strictest attention to general health would combined with the local treatment.

INJURIES OF THE LIDS.

Ecchymosis.—An effusion of blood into the areolar tiss the lids, popularly termed 'a black eye,' is commonly the of a blow; but it may arise from other causes, as, for inst from the unskilful employment of leeches. The suffer always most anxious to get rid of the ecchymosis as quick possible; and I know of no treatment so efficacious as handed down by the traditions of pugilism, consisting in application of a poultice formed of the freshly-scraped root the 'black bryony' (*tamus communis*), mixed with a due prop tion of linseed-meal or bread-crumbs. Poultices of this produce a stinging sensation in the skin, and, if regu applied for a day or two, seldom fail in effecting a comp absorption of the effused blood.

Emphysema.—This, like ecchymosis, is usually the result blow with the fist, which fractures some of the thin bones, such as the lacrymal or ethmoid, forming the inner of the orbit. If, shortly after such any injury, the patient his nose, the eyelids suddenly puff up, so that he is unable separate them. On pressing the part with the fingers, we once perceive the peculiar crackling caused by the presence air in areolar tissue. If the patient abstain from blowing nose, the effused air soon becomes dispersed, and the swel disappears.

Wounds of the lids have already been considered.* They be treated on the common principles of surgery which apply other regions. The careful surgeon would naturally be alive the importance of obtaining the nicest adaptation of cut ces in parts so open to observation. The yielding nature e skin of the lids, and its plentiful supply of blood, offer liar facilities for effecting close and smooth union of wounds means of fine sutures, in applying which the greatest care t be taken to avoid any irregularity and puckering of the t edges.

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* See INJURIES OF THE FACE.

CHAPTER XIII.

DISEASES OF STRUCTURES WITHIN THE ORBIT.

TRUCTURES very dissimilar, as regards their nature and func- ons, are grouped together in the present chapter; but they are l more or less concerned in supporting or imparting motion to e eyeball. The various morbid growths within the orbit, hich cause displacement or impair the mobility of the organ, re also here briefly noticed.

PROTRUSION OF THE EYEBALL.

(*Proptosis oculi; Ophthalmo-ptosis; Exophthalmos.*)

Various causes may induce an unnatural prominence of the yeball; but cases are sometimes met with in which this promi- ence seems of itself to form the whole morbid condition. The yes have a remarkably staring expression, and look as if they were much too large for their sockets. The tarsi can be brought into contact; the eyes themselves move freely in all directions, and sight is unaffected. The equal amount of prominence in both eyes, and their unimpaired functions, at once remove any uspicion of orbital tumour.

Women of feeble and hysterical constitution, and those affected with bronchocele, are the usual subjects of this deformity, the cause of which is very obscure. Atony of the recti muscles has been suggested; and no doubt a weakened state of these muscles might produce a certain amount of prominence of the eye, but would be incompatible with its free motion. I have never seen any cure or benefit result from treatment in these cases of proptosis.

Dislocation of the eyeball from the socket is an accident often hear of, but I need hardly say, that without rupture of optic nerve the eye cannot be thrust upon the cheek, where it often figures in the exaggerated accounts of patients. Wh really takes place is, probably, the lodgment of the upper behind the greatest convexity of the globe. I have seen accident occur, when a surgeon, anxious to explore the surface of the sclerotic, in search of a foreign body, or for other cause, has too forcibly thrust back the upper lid. tarsus, being forced beyond the summit of the eyeball, suddenly slipped backwards, and become fast locked behind A wire elevator or a bent probe will enable the surgeon to up the tarsus and restore it to its place.

Hydatids, cancerous growths, and exostoses, by encroaching the cavity of the orbit, all give rise to gradual displacem the eyeball. As this displacement increases, the movem the eyeball become more and more limited, until at las remains quite fixed.

It requires much careful investigation into the history of case to enable the surgeon to determine the nature of the m growth. Exostoses are the slowest, and encephaloid tum the most rapid in their progress. It is sometimes possib pass in the tip of the little finger between the globe and anterior edge of the orbit, and thus partially to explore the face of the tumour. Hydatid cysts are recognised by a fee of elasticity and fluctuation; and in doubtful cases a punct with a fine trocar will sometimes reveal the true nature of mass.

The removal of morbid growths from the orbit requires utmost care, to avoid inflicting injury upon the eye itself or optic nerve; and, before attempting such an operation, surgeon should be well convinced that the mass is lim to the orbit, and has not extended into it from the cavity of skull.

Abscess in the orbit occurs as a result of injury, such as the trance of a foreign body; or it sometimes seems to be the of a chill. In a less acute form we meet with it as a seque fever and erysipelas. The suppuration is ushered in with ri and depression; the conjunctiva and areolar tissue of globe are red and infiltrated, the lids swollen and livid; eyeball becomes prominent and immovable; and at length tion can be detected by the finger passed in between the lids d the globe. The rapidity with which these symptoms follow ch other would serve to distinguish suppuration from the owth of a tumour. Until fluctuation occurs, the existence pus in the areolar tissue of the orbit is very obscure; and the ep exploratory punctures which some surgical writers advise be made between the eyelids and the globe must be very safe, considering how closely the eyeball is surrounded with uscles and nerves, which random incisions would endanger. careful surgeon may sometimes succeed in safely opening a ep orbital abscess; but I have known a total division of the tic nerve to result from an over bold incision.

Chronic abscess in the orbit is commonly the result of caries or ecrosis; and the denuded bone will be felt by introducing a robe through the opening by which the pus has been evacuated.

Orbital abscess, even of the acute and so-called phlegmonous ind, so commonly occurs in depressed and feeble subjects, that ght and nutritious diet, with a due proportion of stimulants, ill be indicated instead of abstinence and leeches. The bowels hould be rapidly unloaded, and then narcotics given in doses st sufficient to soothe pain and induce sleep. Bark and ammo-ia, wine and other tonics, will often be needed in increased uantities during the free suppuration, which not uncommonly llows the opening of the abscess. Warm water-dressing will e throughout the best local application.

AFFECTIONS OF ORBITAL NERVES.

The eyeball and its appendages derive their sensibility from ranches of the ophthalmic division of the *fifth* nerve, which not nly endows these parts with feeling, but also so far influences heir blood-supply that total anæsthesia of the nerve is followed, ooner or later, by deranged nutrition of the cornea, and by ther phenomena generally described as 'inflammatory.'

These phenomena have been already noticed in the Chapter reating of Diseases of the Cornea; and at present we may con-ine our attention to those motory nerves which supply the muscles of the lids and globe,—namely, the third, fourth, sixth, nd 'portio dura' of the seventh, or facial.

The orbicularis palpebrarum is supplied by the last-named nerve, and when this is paralysed, the tarsi can no longer be brought into contact. If the patient is told to shut the eye, the lids remain immovable, if the paralysis is complete; or if it be only partial, a slight attempt at closure takes place. At th same time the eyeball is rolled upwards by the action of th superior rectus, as if seeking in that way the shelter of th upper lid. Sometimes the branch supplying the orbicula palpebrarum is alone paralysed, but more frequently this i affected in common with the other facial muscles.

The orbital nerves, it will be remembered, are distributed a follows: the third to the levator palpebræ, the superior, inferio and internal recti, and inferior oblique muscles; and also to th iris, through the medium of the ophthalmic ganglion. Th fourth nerve supplies the superior oblique, and the sixth th external rectus.

It is not necessary that all the muscles supplied by one o these nerves should be affected at the same time, or to th same extent; but for the sake of illustration we will assum cases in which the various nerves have wholly lost their motory function.

The following are the symptoms of paralysis of the *third* nerve. The upper lid hangs motionless, and is in contact with the lower one (*ptosis*). On lifting it we find the globe abducted, so that the cornea is turned towards the temple. The patient can direct the eye still farther outwards, but neither inwards, upwards, nor downwards. The pupil is dilated and fixed, and on that account vision, especially for near objects, is somewhat impaired,* although the optic nerve and retina may be wholly unaffected. By looking through a small aperture vision becomes perfect. If the patient looks with both eyes at objects placed on that side of him towards which the affected eye is abducted, they appear single; while objects in the other direction appear double. If all the branches of the third nerve are paralysed, the inferior oblique muscle of course ceases to act, and the superior oblique having no antagonist, rotates the globe on its antero-posterior axis, and hence vertical objects seen with the affected eye appear oblique.

If the *sixth* nerve alone be paralysed, the eye is turned inwards. This inversion can be increased at will, and the eye can be freely moved upwards and downwards; the pupil is of natural size and active, and the upper lid retains its motions unimpaired. If the patient looks at objects on that side towards which the eye is inverted, they appear single; but objects in the other direction are double.

Paralysis of the *fourth* nerve is much less common than either e two forms already mentioned, and, on account of the very t change it causes in the position of the eye, is very diffi- of detection. The paralysis is chiefly to be recognised by objective phenomena. If, for instance, the patient with both open fixes his attention on some straight line on the ground, e edge of a gravel-walk, or the curb-stone of a foot-pave- , he sees two lines, one in its real position, and the other ing with it a more or less acute angle. If with both eyes oks at a near object, such as a large capital letter, at such an that it appears double, the image perceived by the affected vill incline from the perpendicular, and its lines cannot be ght parallel to those seen by the sound eye, unless the nt inclines his head to one side. The letter T or a +, ntaining right angles, are good forms for testing the t.*

e *treatment* of paralytic affections of the orbital nerves be based on a careful investigation into the symptoms of individual case, for the causes of paralysis may be very us. Slow, and eventually total, paralysis of one or all the s which enter the orbit may depend upon chronic changes e brain itself, or the dura mater, the growth of tumours, se of bone, &c. Sudden paralysis may follow apoplectic on or other injury to the cerebral structure, or may depend rheumatic inflammation of the fibrous tissues immediately unding and investing the nervous trunks.

course the prognosis would vary greatly accordingly as one other of these causes had induced the paralysis. In the of chronic brain-disease, or the growth of intracranial tu- s, the treatment could be only palliative. The probability overy in cases of apoplexy would depend upon the extent e extravasation.

one or more of the orbital nerves were suddenly paralysed, t the same time other parts of the body were affected with f motory power, while the brain itself gave evidences of its e circulation being disturbed,—there would be compara- y little chance of the orbital muscles recovering their func- But if the paralysis were so completely limited to one e orbital nerves as to render it probable that only some ite vessel in the course of the motor-tract had given way,

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he use of the oblique muscles appears to be to maintain the eyeballs in a position that their vertical diameters may be always kept parallel to each during lateral inclination of the head.

and had involved the adjacent brain-fibres, the absence of all other cerebral symptoms would warrant the hope that considerable improvement, or even complete recovery, might take place.

By far the most hopeful cases are those where the paralysis of the orbital nerve can be traced to rheumatism; since a well-directed treatment of the general rheumatic diathesis will, in all probability, restore the affected nerve to a healthy condition.

This seems to be the most fitting place for saying a few words about the affection termed *Mydriasis*; for although its manifestation is wholly in the iris, yet the morbid appearance is caused by a loss of motory power in certain branches of the third nerve.

In Mydriasis the pupil is dilated and immovable; and as such a condition is attended with some indistinctness of sight, it often gives rise to extreme alarm, and is regarded as a symptom of 'Amaurosis.' A simple experiment, however, suffices to determine the real nature of the case. Let the patient supply the want of a contracted iris by looking through a small aperture such as a pinhole in a card held close to the eye. If the case be one of *Mydriasis*—dilated pupil, with a sound retina—he will see perfectly; but if the retina be affected, the aperture will either be quite useless, or at the utmost, afford very little assistance.

The *treatment* of Mydriasis is not easily reduced to precise rules, as the affection may originate in various ways. Exhaustion of nervous energy, dyspepsia, intestinal irritation from worms, &c., rheumatism—all seem in turn to be the exciting cause. Tonics, alone or in combination with purgatives, colchicum, strychnine, as an internal medicine, or applied 'endermically,' powdered ergot of rye, snuffed up the nostril of the affected side,—all these and other means have been employed with but little success. The discovery of the remarkable property of the Calabar bean has at once placed at our command a substance which induces contraction of the pupil as completely as atropine dilates it; but I have not met with a case of true mydriasis in which the Calabar bean, however efficacious at the time, has produced a permanent cure. It is best used by means of little disks of gelatine, on the principle invented by Streatfeild for the application of atropine.

A very contracted and immovable state of the pupil is described ome writers under the name *Myosis*, but it is seldom met as a simple and independent affection. Some persons who naturally very small pupillary apertures enjoy such excel- ight, that we must be cautious how we call such a state of pils morbid. Extreme contraction of the pupil, however, ymptom of irritation of the sympathetic nerve; and it d therefore induce the surgeon carefully to examine the ition of this nerve in the neck, as being possibly pressed and irritated by some tumour or morbid growth.

STRABISMUS.

he various forms of mal-position of the eyeball just noticed, nding upon more or less sudden paralysis of the ocular cles, might, according to strict etymology, be classed under *bismus*; but, practically, the term is restricted to those nic cases in which habitual mal-position results from irre- r action of either the internal or external rectus. The de- ity may be defined as a faulty position of the eyes, whereby parate image falls upon each macula lutea, when the nt endeavours to direct both eyes to one object at the same .

rabismus may be either *convergent* or *divergent*. In the for- case the eye, or eyes, will be directed towards the nose: in latter case towards the temple. The strabismus is termed gle' if one eye only is misplaced, and 'double' when both converge or diverge. In many cases which ordinarily ap- r as double strabismus, one eye becomes perfectly straight ever the patient fixes his attention on an object; and the which thus for a time acquires a normal position will be d to have the stronger powers of vision.

n other instances of double strabismus both eyes maintain r inverted position, even while the patient is intently ob- ing an object; but if the surgeon suddenly closes one of e convergent eyes, the other at once becomes straight, re- ing its inversion as soon as the other eye is opened.

onders has shown that in the great majority of instances ergent strabismus is associated with hypermetropia; and divergent form with myopia. Divergent strabismus how- is rare, except as a consequence of considerable loss of t in one eye, persisting for several years.

he *causes* of strabismus are very various. When existing only to a slight degree, coming on only occasionally, and alte nating from one eye to the other, it will sometimes be fo due to intestinal irritation, such as that arising from wo In other cases, it may be traced to the temporary cerebral di turbance induced by teething, or to the more persistent fo which attends hydrocephalus. An opacity near the centre o the cornea will sometimes cause an eye gradually to turn inw through a sort of instinctive effort of the organ to bring a cl portion of the cornea into use.

The *treatment* of strabismus, as will be evident from wha have just said as to its causes, must vary according to circ stances. The removal of intestinal irritation; the use of toni the employment of convex glasses, to correct extreme hyper tropia;—these, and many other means, may be useful to cor strabismus which is only temporary, or which arises fr peculiarity in the visual focus of the eyes. In every ca careful ophthalmoscopic examination is the first duty of t surgeon; and he should also take every possible care to ascert that no organic disease exists in the brain or orbital nerves, a that there is no tumour in the orbit mechanically hindering t movements of the eye.

The *operation* for the cure of strabismus consists in the divi of the muscle, which, in consequence of shortening, or too gr preponderance in contractile power, is permanently draw the eye either inwards or outwards. Division of the inter rectus, when first introduced, was performed in the follow way. The lids being held apart by an assistant, a small sh hook was stuck into the sclerotic, close to the inner margin the cornea, so as to fix the eyeball and draw it outwards. Th the surgeon, raising with a forceps a fold of conjunctiva mid between the cornea and plica semilunaris, divided it vertic with scissors, snipped through the sub-conjunctival ti covering the tendon of the muscle, passed under it a blunt ho or director, and upon this divided with scissors, or with so kind of knife, either the tendon itself or the adjacent musc portion of the rectus internus.

As in all other instances of manual surgery, the apparatus f performing this operation gradually became simplified. Th spring speculum superseded the elevators held by an assista the sharp hook for fixing the globe was laid aside; and it w found that all the cutting could be done with scissors alo The curious little knives, in every variety of form, which ha

ated for dividing the muscle, are now for the most
tten; as are also the unseemly disputes about priority
discoveries, and the exaggerated accounts of the uni-
ss which was stated to have attended the practice of
abismus operators.

ects of this earliest form of operation were a too great
of the ocular conjunctiva, inducing a subsequent
of the semilunar fold, and an over weakening, amount-
mes to utter loss of action, in the divided muscle.

occasionally meet with a fixed and leering eye which
period of the first introduction of the operation in
en, without the ophthalmoscope to facilitate dia-
ry tyro fancied himself competent to cure a squint.

rmity arising from retraction of the semilunar fold
great measure obviated by sub-conjunctival division
cle. The lids are kept asunder with a spring specu-
an assistant draws aside the globe, by nipping up
rceps a little fold of loose conjunctiva near the margin
ea, at the opposite side to that on which the muscle
ivided. Supposing the internal rectus to be chosen
on, the surgeon, with scissors, divides the ocular
horizontally, on a level with the lower edge of the
d extends the incision towards the semilunar fold.
ips through the sub-conjunctival tissue, and having
osed the sclerotic, slides upwards, between it and the
rved director. This serves to raise the muscle and
fibres tense, and then with scissors the muscle is
it through, close to its insertion into the sclerotic.
n of the muscle cannot be completed at a single
requires repeated use of the scissors, so that no
be left undivided.

his sub-conjunctival operation through a horizontal
ound obviates the retraction of the semilunar fold, it
e risk of an imperfect division of the muscle, which
sed to the view of the surgeon. A careful explora-
he blunt hook or director must be made to detect
ided fibres, before the spring speculum is finally

ivides the conjunctiva a little below the equator of the
few lines from the cornea, almost over the insertion
don; exposes the sclerotic just enough to pass a
it hook beneath the tendon, which is drawn well into

the conjunctival wound before using the scissors. It is snipped through close to its sclerotic attachment; care taken that the hook, which is sharply curved, is not allowed perforate the tendon, but is passed well under it. In operation the tendon is brought quite into view, and is likely to escape division, which is one of the dangers of sub-conjunctival operation.

In dividing the *external* rectus, it must be borne in mind the muscle is broader than the internal rectus, and is inserted farther from the corneal margin.

Most cases of strabismus require the division of each rectus, even when the inversion of the better eye is but comparison with the other. Instances, however, occur in the inversion is wholly confined to one eye; and in such the faulty eye may alone be operated upon.

No absolute rule can be laid down as to the use of in strabismus operations. In most cases it will be necessary; but where patients are fitted by age, and self-command to undergo the operation without it, the which sometimes exists as to whether the muscle has effectually divided can be at once solved, by directing patient to attempt inversion of the eye; a test we are employ when insensibility has been induced.

When, in searching for the muscle, the areolar tissue has been largely separated, it becomes with blood, and forms a little prominence in the wound. blinking of the lids gradually moulds this into a small shaped excrescence, attached by a narrow pedicle, which may snipped through some weeks after the operation.

REMOVAL OF THE EYEBALL.

Certain diseased conditions of the globe may require a of it to be removed, while in other cases its tissues may extensively involved, and so much constitutional may in consequence arise, as to render necessary the total tirpation of the whole organ.

In non-malignant cases this operation is usually with a prospect of the patient afterwards wearing an eye; and it therefore becomes important to consider total or a partial extirpation will be best adapted to the view.

nlargements which call for removal, on account of the ty they occasion, are chiefly staphylomatous projections cornea or the sclerotic. Under the former term are ly included projections which have really little or no tissue within them, being formed of the iris coated over rous tissue, after the true cornea has been partially or destroyed by ulceration or sloughing. The sclerotic mata, as they are called, are produced by gradual g and distension of the weakened fibres of the part cumulation of aqueous humour or of serum. In some of er cases the eyeball acquires a very large size, and is ly unsightly, on account of the dark leaden-coloured ons of the sclerotic, and the large tortuous veins which over it. When the cornea has been extensively des- by sloughing or ulceration, it very commonly happens e lens escapes through the breach; when this does not ace, the lens frequently becomes filled with a deposit phate of lime, and this earthy mass, by pressing against ary processes and iris, often causes severe neuralgia. In a staphyloma, therefore, the opening should be made tly large to allow the lens, if still existing, to escape.

erating, the lids must be held apart with a spring spe- r the fingers of an assistant. The surgeon then passes act-knife through the staphyloma, and forms a flap, e seizes with a forceps, and removes with a second f the knife; if the lens presents at the opening, it is to kly tilted out with a scoop, and then the lids are in- to be closed, and a cold sponge applied firmly over This immediate pressure is the most likely means for ing hæmorrhage from the enlarged choroidal vessels, sometimes give way the moment the fluid contents of be have escaped. Moderate pressure should be kept up e risk of bleeding has gone by, and then water-dressing the only application required till the parts are healed.

rtion of the globe left after the excision of a staphyloma lly shrinks to a nodule, and as soon as this has ceased to er, an artificial eye may be applied.

n consequence of the sudden removal of the pressure the accumulated fluids of the globe had been exerting on roidal and retinal vessels, the latter give way, and blood d distends the cavity of the sclerotic, extreme pain is sult, and it may even be thought desirable at once to

extirpate all that remains of the globe, with the view of
venting future suffering. With the object of obtaini
better stump on which to wear an artificial eye, Critchet
modified the operation for staphyloma as follows. He p
several curved needles armed with threads through the s
tic, above the base of the staphyloma, quite into the vit
chamber, and brings out their points at the opposite si
the projection. He then cuts away an elliptical portion
the front of the mass, draws the ligatures quite through
ties them in knots, which then lie just across the line o
closed incision.*

Total extirpation of the eyeball.—This operation, except
malignant disease exists, should never be resorted to, s
as any sight remains in the organ; unless it should
irritable as to lead the surgeon to fear that, by spari
the sight of the fellow-eye may be endangered. Rest
within due limits, and not undertaken through a morbi
of operating, extirpation of the eyeball is a ready me
relieving patients whose whole system may have becom
paired by long-continued neuralgia, arising from disten
the globe, or lodgment of foreign bodies within its cavity.

The operation, which was formerly effected by scoopi
all the contents of the orbit, has been greatly simplifi
the adoption of Bonnet's method, in which the globe a
removed. A circular incision is made through the conju
and ocular fascia, and then each muscle of the eyeb
successively divided close to its insertion, and the optic
just before it pierces the sclerotic.

The operation is usually performed by raising with a ho
the tendons of the ocular muscles, and dividing them
cutting through the optic nerve.

I prefer the following plan, as simpler and more
Having inserted the spring speculum between the lids
made with curved scissors the usual circular incision o
conjunctiva, I grasp the external rectus and its surrou
tissue with a forceps, and snip them through; an assista
once seizes the cut tendon close to its insertion, and draw
eye inwards. By sliding one blade of the scissors unde
superior oblique and rectus muscle, they can be divided
then the inferior rectus. The optic nerve is next se

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[*] *Ophthalmic Hospital Reports*, vol. iv. p. 1.

ugh, and the globe starts forward. A few strokes of the
ors divide the inferior oblique, internal rectus, vessels, and
of areolar tissue, and the operation is completed. Cold
r and exposure to the air suffice to arrest the bleeding, and
water-dressing is all that is required.

USE OF CHLOROFORM IN OPHTHALMIC SURGERY.

e may regard chloroform under two aspects: as saving the
nt from pain, and as facilitating the manipulations of the
on. Now it is well known that operations performed on
globe itself cause little pain, and last but a very short
Those on the lids, involving as they do the wounding of
are of course more painful; but none of them are in this
ct comparable to the larger operations of general surgery;
there are few adults who, if properly informed as to the
nature of such operations as those for cataract, artificial
, and strabismus, will not readily undergo them without
id of anæsthetics. There are, however, many timid and
us persons who are quite unable to go through the opera-
for artificial pupil and strabismus except under chloro-
, and very few without its aid can encounter extirpation of
yeball. It is also occasionally necessary to induce insensi-
in order to examine eyes rendered irritable by disease, or
e presence of foreign bodies. In children all ophthalmic
tions are greatly facilitated by the use of chloroform, and
can hardly be performed without it.

a perfectly passive condition of the eye is so desirable
g the delicate operation of flap-extraction, one would
rally expect to find chloroform peculiarly indicated in such
se. But it forms, I think, a special exception, for the
wing reasons. We have already seen (p. 186) that, when
operation of extraction has been properly performed, a
essful result chiefly depends upon the rapidity with which
n of the corneal wound can be effected. Now, with every
aution in the administration of chloroform, it will occasion-
induce sickness; and the effort of vomiting may cause
itreous body to escape through the opening just made in
cornea, thus inducing prolapsus iridis, with all its conse-
t irritation and hindrance to union of the wound. But,
without assuming so extreme a case, we shall find a very
us objection to chloroform in the nausea and disrelish for

food which often follow its inhalation, whereby the nutrition and reparative power of the cornea become impaired during the critical twenty-four hours immediately succeeding the operation.

JAMES DIXON.

DESCRIPTION OF PLATES.

The more experience one has had with the ophthalmoscope, the more one feels the impossibility of illustrating by any single drawing the normal fundus of the eye. So many variations of form and colour are compatible with good sight, that such a single drawing can merely serve as a rough indication of what a beginner with the ophthalmoscope is to look for in his first examinations.

Plate I., fig. 1.—A plan of the healthy fundus of the eye in a person of fair complexion. The optic nerve and the yellow spot are not really to be seen at one view, as they are here represented. To see the former the surgeon must tell the patient to turn the eye a little inwards; but to look directly forwards when the yellow spot is to be examined. In persons of fair complexion the site of the spot is usually marked by a tint redder than that of the neighbouring retina, and it is not crossed by any large artery or vein. The fundus of the right eye, which is here represented, is shown reversed, as in the indirect examination, so that the yellow spot, which is really external to the optic nerve, appears to its inner side. (See p. 24.)

Fig. 2.—This is a diagram, not a drawing from nature. It shows in a rough manner the abrupt curving of the vessels, the concave form of the optic disk, and the grey tint which the latter sometimes assumes in the very advanced stage of true glaucoma, or of grey atrophy of the optic nerve. Such a change in the nerve as is here shown, in respect of its outline, its concavity, and its colour, would only be met with when disease—such as chronic glaucoma or primary grey atrophy—had existed a long time. Curving of the vessels, but to a much less extent than is here shown, and with less, if any, change of outline in the disk, is met with during the preliminary stage of glaucoma. The appearances during the acute stage of an attack cannot be depicted, because the changes in the corneal epithelium, and the cloudiness of the vitreous humour, which accompany that condition, prevent a clear view of the fundus being obtained. Mr. Burgess is not responsible for these two figures, which are from drawings of my own.

Plate II., fig. 1, shows numerous patches of absorbed choroid, with pigment deposits, from a woman, aged thirty-eight, who, eight or nine years before, had suffered from syphilis. (See p. 107.)

Fig. 2.—Extreme pigmentation of the retina in a man of fifty, who was nearly blind from 'retinitis pigmentosa,' which had been gradually advancing from childhood. The two eyes were almost exactly alike. The optic nerve was pale; and the retinal vessels were very much diminished in size. (See p. 1

Plate III., fig. 1, is intended to show the appearances presented by the choroidal vessels when they are exposed to view by the absence of that layer of cells which in a healthy state is interposed between the choroid and the retina. In this figure isolated patches of this layer are still to be seen. The choroidal vessels are represented as rather too uniform in size, but their closely set meshes, with the intervening masses of black pigment, present a marked contrast to the long isolated vessels of the retina. (See p. 26.)

Fig. 2 shows very well the homogeneous white disk and contracted vessels of an optic nerve which has undergone 'white atrophy.' (See p. 124.)

PLATE I.

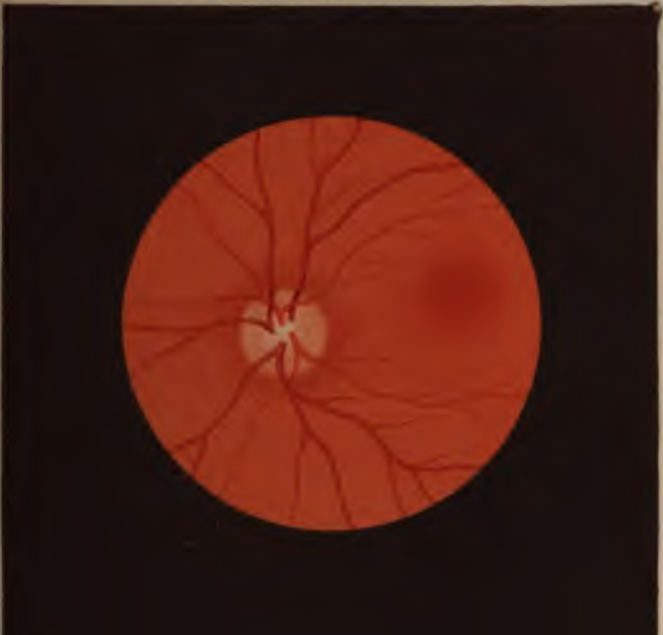

Fig. 1.

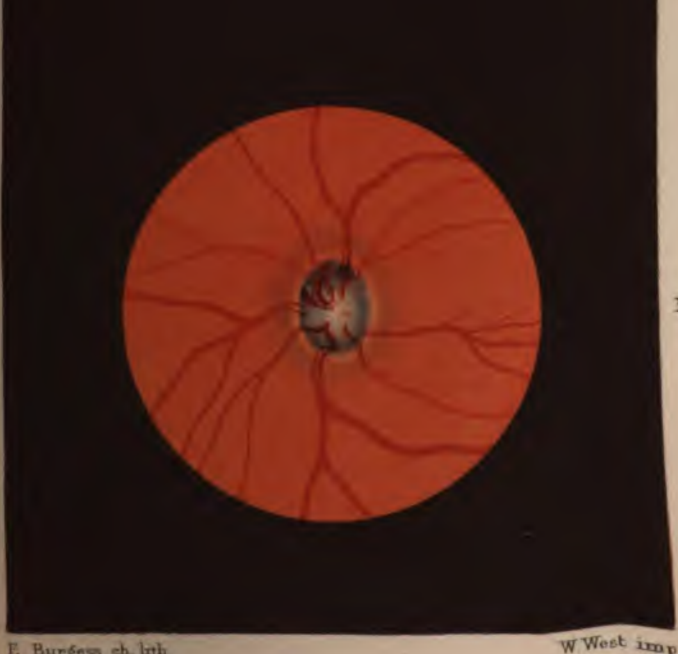

Fig. 2.

E. Burgess ch. lith.

W. West imp.

PLATE. II.

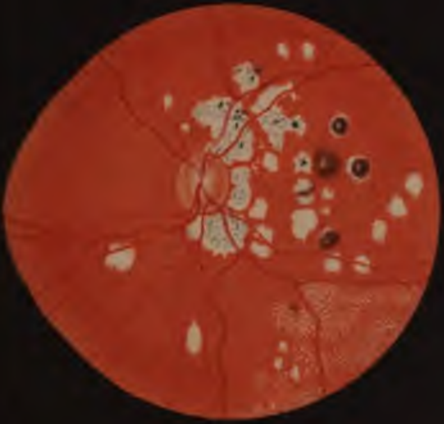

Fig. 1.

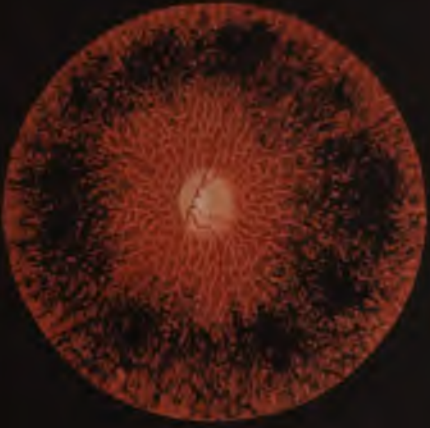

Fig. 2.

ss del. ad nat. et ch. lith.

W. West imp.

PLATE. III

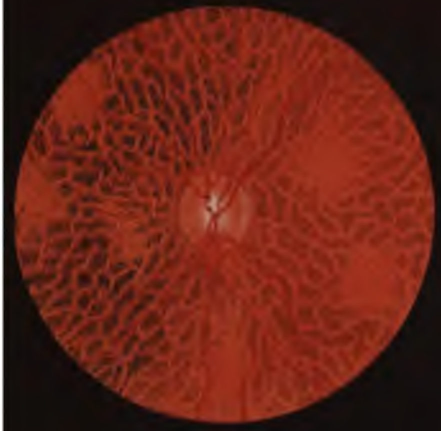

Fig. 1

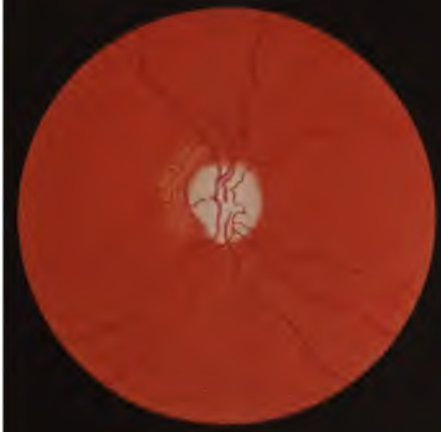

Fig. 2

el ad nat. et ch lith W West imp

DISEASES OF THE EAR.

HE diseases of the Ear naturally divide themselves into three classes, in conformity with the anatomical structure he organ—those of the external, of the middle, and of the rnal ear. The first class includes the affections of the icle and of the external meatus; the second, those of the mbrana tympani, tympanum, mastoid cells, and Eustachian e, with the adjacent regions of the throat; the third em- ees the diseases of the labyrinth and of the auditory nervous aratus, so far as it comes within the reach of our investiga- n. In addition to these, certain diseases not capable of strict al definition, and the effects produced upon the brain and er organs, chiefly the lungs, by inflammation commencing hin the ear, will require description.

I. Affections of the External Ear.

alformations.—The surgeon is occasionally consulted for rnal malformations of the ear. These vary in extent from ntire absence of the meatus and its appendages on the one d, to the presence of a double set of organs on the other. most frequent malformation is an imperfect development the meatus and auricle; the former being reduced to a row slit in the temporal bone, and the latter existing only a slight fold of the integument. The tympanum also, in ne of these cases, is merely rudimentary, consisting of an gular aperture a few lines in diameter, and the ossicula are e or less defective. Sometimes a single bone, resembling columella of birds and reptiles, takes their place. The rinth is in these cases most frequently normal, and a tain amount of hearing is usually present; often it is so siderable as to enable the patients to perform useful duties. the most part extensive deformity is present, from absence lefect of other portions of the skull, as the malar bone, or the zygoma; and the orifice of the meatus may seem to lie very much anterior to its normal position. Operative proceedings have not been found beneficial in these cases, nor in those in which, with a more or less perfectly formed auricle, the cartilaginous portion of the meatus is also perfect but ends in a cul de sac. The bone beneath is generally found solid. In another class of cases, however, in which the defect is confined to a contraction of the meatus at its orifice, from a falling back of the tragus, or projection forwards of the antitragus, efficient assistance can be rendered by the prolonged use of a tube adapted to the size of the canal; or excision of a portion of the offending cartilage. Congenital closure of the meatus by a false membrane, sometimes superficial, sometimes deeply seated, near the membrana tympani, is said to have occurred, and to have been remedied by the division of the structure, followed by the introduction of tents.

Supernumerary auricles are sometimes met with, growing from the sides of the neck.

In the ninth volume of the *Transactions of the Pathological Society*, Mr. Birkett relates a case of this kind. The structures consisted partly of a tissue like the lobe of the ear, and partly of fibro-cartilage, the shape of which 'resembled more or less closely, in parts, that of the proper auricle; and its tissues were the same.' They were excised without difficulty, and appeared to be merely cutaneous appendages, not extending more deeply than the fibres of the platysma myoides.

Injuries of the auricle, and the lodgment of foreign bodies in the meatus, will be found treated of in the essay on INJURIES OF THE FACE.

The auricle is subject to various *cutaneous affections*, herpes, impetigo, pemphigus; but the most important are chronic erysipelas and chronic eczema. Both these conditions are most frequent in women past middle age, though the latter is also met with in children. In chronic erysipelas the entire auricle becomes greatly thickened, so that its outline is almost lost. The skin is red, dry, and hard, and covered with desquamating epidermis. The swelling encroaches on the meatus, the orifice of which is narrowed and frequently obstructed with epidermis. There is constant itching, but not much pain, though the parts are tender. Sometimes the affection dates from a pre attack of acute erysipelas, extending over the side of the h sometimes it seems to be local from the first. The health riably deranged. The *treatment* consists first in cleanli- , the discontinuance of wrappings, and free exposure of the s to the air. When the inflammatory thickening and irri- on are considerable, poultices may be applied at night. A inued use of astringent lotions is needed to restore the thy action of the skin. A solution of nitrate of silver v.—℈j. to ℥j.), used alternately with others, has consider- effect. Glycerine is often very soothing; or the ear may covered with collodion, renewed daily. The constitutional tment should be conducted on the usual principles. Debility enerally, but by no means always, present. A permanent traction of the meatus sometimes results from this disease. effects may be mitigated by wearing a small silver tube urately fitted to the parts.

In chronic eczema the auricle presents less thickening than the last-mentioned affection; but it is considerably swollen, ered more or less with brown or yellow crusts, and, when se are not present, exudes a watery fluid. A similar erup- n is generally present on the scalp, or on other parts of the dy. The diseased condition mostly extends into the meatus, d more or less deafness is present. It is attended with great hing. The membrane is generally somewhat reddened and ollen. The *treatment* is the same as for other forms of zema; but the meatus should be well syringed out with warm ater frequently, to prevent discharge from accumulating within , and in the later stages of the disease may be washed with a lution of the nitrate of silver, or with citrine ointment diluted ith glycerine or almond oil. If, after the eruption has ceased, here remain any degree of hardness of hearing, dependent pon a thickening of the membrana tympani, the case would ome within another class of affections—those of the middle ar.

Gouty deposits are met with in the auricle; and congestion f the cartilage, arising from the same cause, is sometimes met with. Excoriations are not uncommon in children; but they are readily cured by cleanliness, with or without mild astringent lotions. Great care should be taken to dry the ears and hair of children after washing. In inflammatory affections of the auricle or meatus the glands beneath the angle of the jaw generally become somewhat swollen and tender; occasionally suppuration occurs in them. Paralysis of the facial nerve may result from their pressure.

Tumours of the auricle.—Of these three chief forms have been described:

1. A fibrous growth of great hardness, forming in the cartilaginous portion, and giving rise sometimes to great inconvenience. This is rare in England, but in the American *Journal of Medical Science* for October 1860, it is stated to be much more common in negroes. Fibrous tumours also form in the lobe, around the hole from which the ear-ring is suspended. In either case they are easily removed.

2. Cystic disease. Under this name two distinct affections have been described: one consisting of a sac containing a glairy tenacious substance, the other being an infiltration of the tissues of the auricle with a sanguinolent fluid. The latter is the disease met with so frequently in the insane, known under the name of hæmatoma auris. Whether this affection arises from injury is still a matter of discussion among those who have charge of the insane. For treatment, Dr. Thurnam (as quoted by Mr. Toynbee) recommends, in the acute stage, 'the use of evaporating lotions; at the end of a week or two a seton should be passed through the long axis of the swelling, and the contents pressed out. Under the use of the seton the tumour gradually subsides.' In the treatment of the ordinary cysts Mr. Wilde recommends that they should be laid freely open, and dressed from the bottom with lint.

3. Steatomatous and fatty tumours are also met with in the auricle, as well as a pendulous state of the lobe, which may reach an extreme degree, especially if goitre be present. This part is also subject to nævus, which may lead to its destruction to a greater or less extent; and erectile tumours have been met with in it, causing hæmorrhage. For the treatment of the latter affection, reference may be made to the section on VASCULAR TUMOURS in vol. i. p. 541.

II. AFFECTIONS OF THE EXTERNAL MEATUS.

In some cases in which this passage is wide and short, the greater part of it and the membrana tympani can be examined by placing the patient in a good light, and gently elevating the helix with one hand, while the tragus is drawn forward the other. For the most part, however, this is not poss and a speculum is necessary. The best form is a silver tu val shape to fit the meatus, with its smaller end continued he same diameter for about half an inch. This instrument, which it is desirable to possess different sizes, admits the gest possible amount of light, and adapts itself easily and nlessly to the canal, in which it will remain fixed while the geon's hands are free. By moving it slightly in different ections the inner part of the meatus and the membrana pani can be examined. A very good view may be obtained causing the rays of the sun to fall through this speculum o the meatus, which may be effected by placing the patient the sunlight, with his head inclined at a suitable angle t, as a rule, it is better to use a reflector, and employ the fused daylight. If artificial illumination is necessary, it may supplied either by means of a jet of gas conveyed by a flexible be to a small stand furnished with a reflector, or by a reflector tached to an ordinary candle, or by the lamp invented by Dr. owne, and known as Miller's lamp. In using the speculum, e curve of the meatus forward should be remembered. In ung children the meatus is very shallow, the osseous portion nsisting only of a small ring of bone (deficient at the per part), to which the membrana tympani is attached in a ry horizontal direction. The speculum, therefore, should be ed in their case with great caution. The points to be noted the examination of the meatus are, the size and calibre of the nal, whether normal or infringed upon; the presence or absence extraneous bodies and of cerumen; and the condition of the ning membrane.

Accumulation of cerumen.—The presence of wax appears to only in a minority of instances the sole cause of the deafness at accompanies it. Mr. Toynbee found a perfect restoration hearing effected by the removal of cerumen in sixty ears only ut of 165.

Besides interfering with the hearing, accumulations of ardened wax may produce various ill effects. They may ccasion (probably through pressure on the membrana tympani nd ossicula) very distressing nervous symptoms; not only noises in the head' of various kinds, but giddiness, confusion, nd even unsteadiness of gait, exciting the gravest apprehenions in the patient's mind. Further than this, they may even ause absorption of the bony walls of the meatus. This occurs pecially in the old, in whom neglected accumulations have existed for many years. In some cases of this kind the osse plate that separates the cavity of the meatus from that of t mastoid cells is completely penetrated.

Deafness caused by cerumen for the most part presents pe liar symptoms, and a tolerably good diagnosis may often be b on the history of the case. The hearing generally varies; it often better in the morning, or is improved by eating, or by r bing the meatus with the finger. Very often it comes on sudde especially after exposure to cold. This is probably due to slig inflammatory swelling taking place in the meatus, and conve ing a partial into a complete occlusion. This circumstance h frequently led to the employment of the most misplaced deplet and other treatment in cases in which an inspection of t meatus has not been made. There is, however, another form deafness which comes on suddenly after exposure to severe long-continued cold, or cold and wet, and appears to depe upon an abolition of the function of the nervous apparatus. Th great degree of the deafness, however, compared with the sligh ness of the apparent cause, together with the previous history, may serve to distinguish the effect of cerumen from the last-named affection. But it should be needless to remark that n treatment for any aural affection should be undertaken till a complete examination of the meatus has been made. If cerumen be present, it is best removed by syringing. The most efficient form of syringe is one fitted with a separate nozzle of small size, since a small jet of water acts more effectively, and presents less obstruction to the returning stream. The nozzle should be taken off each time the syringe is filled. If this form of syringe is not used, care must be taken that the meatus is not obstructed by the instrument. In syringing, the meatus should be straightened, by drawing back the auricle with the left hand, and gently pressing forward the tragus by resting the nozzle of the syringe upon it; my own practice is to direct the stream along the roof of the meatus. Care should be taken that the fluid is of the right temperature; it should never be below that of full blood heat. If too cool, or too hot, giddiness is produced. In ordinary cases, warm water only need be used. The use of the syringe should never be carried beyond a moderate extent at any one time, and should be discontinued if the patient complains of pain. It is much better to repeat the process several times than to run any risk of producing irritation, the effects of which are sometimes very difficult to allay. Cases

r in which the most distressing and obstinate noises in the
have supervened upon the removal of wax by the syringe;
in some of these I have found that even the most gentle
loyment of that instrument tends to aggravate the symp-
If the wax is not removed in a moderate time, warm oil
lution of soda for a few nights will generally sufficiently
n it. This, however, is not always the case; sometimes the
ed cerumen, mingled as it is with epidermis, is of almost
y hardness, and the parts at the same time are acutely
er, so that the most prolonged and gentle treatment is
ary to give relief. The ear should be frequently examined
the speculum, to ascertain whether any wax remains;
although the last portion generally comes away in a
mass, presenting a cast of the membrana tympani, this
t always the case. Small masses of hard cerumen some-
collect in contact with the membrana tympani, and occasion
h annoyance, in the form of itching and tinnitus. The
ulum reveals the nature of the case, and syringing, which
etimes needs to be repeated, relieves it. A similar irritation
follow from the falling in of a hair upon the membrane;
probably in these cases there already exists a morbid irrita-
ty of the organ.

fter the removal of cerumen, the membrana tympani is gene-
y seen to be of a more or less sodden and opaque appearance,
thickening of its epidermoid layer; sometimes it is red and
ular. In many cases the hearing only gradually returns;
sometimes, when the immediate improvement has been but
ht, it will rise by degrees almost to its normal amount. Time
ld therefore be allowed for this result before other measures
adopted. This affection is apt to return; nor have I seen
cient evidence to show that applications to the meatus can
d it off.

esides accumulation, the secretion of wax is subject to other
rders. In children it may become increased in quantity,
l, and offensive; this being often the first stage of catarrhal
mmation of the meatus. In adults it is frequently entirely
nt; but this is for the most part merely a concomitant of
rnal morbid conditions, and is itself entirely without in-
nce on the function of the ear. Sometimes, though not
ays, the reappearance of the normal secretion attends or
gnosticates a favourable issue of the case.

In the majority of the cases in which accumulations of wax

are found, there exists also a *desquamation of the epidermi*
it is not uncommon to remove large masses of the latter,
or less mingled with cerumen. Sometimes an obstinate ten
to desquamation exists without any other apparent affect
the meatus, and this may or may not be accompanied by
of the internal or middle ear. It may occur in connectio
a general morbid irritability of the organ, or with tinnitu
in the latter case the irritation of the loose masses of
may aggravate the noises to a most distressing degree.
treatment in such cases must embrace the improvement
general health and the strengthening of the nervous
Local applications require to be very carefully employed
ordinary astringents are ill borne. In this respect the co
differs from the common chronic inflammation of the
A few drops of oil applied occasionally facilitate the ren
the flakes.

An enormous amount of injury is done by well-
nurses, who think the ears of children require to be
out by inserting into them the screwed-up corner of
Dense masses of mingled secretion and epidermis beco
pressed down upon the membrane and often fatally i
I question indeed, whether this practice may not rank
scarlatina among the causes of disease of the ear in chi

As long ago as 1844, Mayer reported a case of vegetal
site in the external meatus, and recently, among ot
Wreden has directed much attention to this subject.*
sence of the parasite is indicated by the production of den
flakes within the meatus, which are obstinately reprodu
membrane has never been found perforated, and no dis
present. The growths hitherto met with appear to b
Aspergillus and Ascophora, and both filaments and spo
been met with in great abundance. Dr. Wreden reco
as the best application a solution of hypochlorate of li
one to two grains to the ounce. It should be pure an
dissolved in water. Liquor Plumbi in moderate solut
also been found successful. I believe the affection is m
mon on the Continent than in England.

Abscess in the meatus.—This is an acutely painful, th
otherwise serious affection. It occurs generally in perso

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* Wreden, *Die Myringomykosis Aspergillina*, St. Petersburg,

life, and consists in the formation of one or more small
ses in the outer part of the meatus. The affection is apt
r, and may coincide with the formation of boils in other
f the body. While the abscess is forming, there is acute
f a throbbing darting character in the meatus, often ex-
g over the side of the head. The parts are extremely
, and the attempt to introduce the speculum causes great
s. The hearing may be temporarily impaired by narrow-
closure of the canal. Incision is generally the best
ent; but relief is given by the free use of poultices and
tations, which should be applied as hot as they can be
In almost all these cases a similar constitutional treat-
is indicated as for 'boils' on other parts of the body.
there has existed a tendency to their continued recur-
the sesquioxide of iron in free doses has appeared to me
useful.

ammation of the meatus.—This affection is either acute or
c; it is frequently connected with diseased conditions of
parts of the ear, the membrana tympani, tympanum, and
id cells; in fact a discharge from the meatus should
excite suspicion of disease of the lining of the tympanum:
sometimes exists without the presence of more deeply-
disease, especially in its earlier stages. Neglected in-
ation of the meatus, aggravated as it constantly is by
ed and decomposing discharges, has a great tendency to
d inwards, especially perhaps in children and among the

early symptoms are similar to those which characterise
rmation of abscess. The pain, however, is generally less
; it is of a dull aching character, and is increased by
n of the jaw. The meatus is tumefied, red, and tender.
repeated attacks, it may be so swollen as almost to obli-
the canal, but no local swelling is to be observed. The
bouring glands of the neck are often enlarged and tender.
earing is not much impaired unless the canal is almost
, or the tympanum implicated. The health is almost
s disordered, and some of the severest and most obstinate
I have seen have occurred in patients subject to gout.
ccess of the disease is generally attributed to cold, or
on the head may occasion it. Sometimes there occurs at
rly period of the affection an extremely profuse watery dis-

charge, almost equal to that which follows certain fractu the skull; sometimes the inflammation subsides without a charge; sometimes it is followed by a secretion of viscid or of pus; or it may run into the chronic form of the di

In the *treatment*, the mere cleansing the meatus wit water gives great relief, which is increased by hot fomen and poultices, and it is probable that in some cases these might suffice. The health, however, is generally more deranged, and the constitutional remedies either for deb visceral derangement are indicated. Often also the sev the pain demands local depletion, by leeches, around the of the meatus (the passage being guarded by cotton-wo the employment of morphia in full doses to give rest.

After the inflammatory action has subsided, the oint the nitrate of mercury diluted with oil may be smeared o surface of the meatus, or a solution of the nitrate of sil or ten grains to the ounce, applied with a camel's-hair Care is needed to avoid a relapse.

A similar treatment is also often the most efficaciou later stages of the *catarrhal* inflammation of the meatu is attended with more or less profuse semi-purulent di But so far as I have observed, this condition is a concom a similar affection of the tympanic cavity. Many case apparent catarrh of the meatus are really cases of perforation of the membrane. In so far as the meatu cerned, cleanliness is of course essential, and a mil astringents with discontinuance (as a rule) of the use o wool are to be recommended. But syringing by the or his friends is seldom effective, and is very apt to b source of irritation. It is better to fill the ear a fe with any lotion and let it run out after one or two m or if a syringe be used, the best form is a glass tumb the lower part of which a flexible tube is introduced, the being made to flow by raising the tumbler. But the c very few in which the chief treatment should not be dir the tympanum or throat. For healing the irritable su the meatus I have known the blowing in of powde succeed after the most various moist applications ha The health being almost always deranged, especially in c tonics are indicated; quinine, iron, and cod-liver oil. Forster speaks very highly of the effects of chlorate o given in free doses.

ic inflammation of the meatus sometimes follows the
rm of the disease; sometimes it results from repeated
ttacks. A common cause is the habit of prolonged
, or damping without drying the ears or hair. Without
siderable amount of pain, a feeling of uneasiness in the
is complained of, a sensation of tension, and often of
prompting the patient to introduce pins or other sub-
with the view of allaying the irritation. This practice
se maintains and aggravates the disease. The meatus
n, and the epidermis becomes thick and peels off, often
lating to a great extent. Sometimes the entire cuti-
ning of the canal becomes loosened, and may be with-
n a form resembling the finger of a glove, the inner
ty presenting an accurate cast of the membrana tympani.
vorst cases the walls of the meatus are of a dusky-red
eneath the epidermis, and tender. The wax is deficient,
ring is most frequently impaired, and the membrana
vascular on its external surface. Indeed, this condition
meatus seems seldom to exist without disease of the in-
tructures, the treatment of which is then of the primary
nce.

r of the above-described forms of inflammation may, in
hy subjects, extend to the osseous walls of the meatus,
e rise to caries or necrosis. This result is chiefly apt to
cachectic children.

times a considerable part of the wall of the meatus or
astoid process will come away; and it is remarkable to
at an extent this may take place without any consider-
pairment of the functions of the ear. With the view
ing the extension of the disease inwards, the greatest
uld be taken to secure a perfectly free exit for the dis-

litic disease of the meatus.—This occurs chiefly in the
fissures or of condylomata around the orifice. But I
n another condition which appears also to be due to the
poison. The meatus is ulcerated at its outer part, the
ving irregular edges and a foul surface, and a copious
ge flows from the passage. When it is cleansed, the
n shows its surface reddened, and excoriated in parts;
mbrana tympani is vascular. I suspect the disease
sometimes from the direct application of the poison.

The treatment would be conducted on ordinary principles. In some cases an enormous swelling of the auricle attended with ulceration occurs.

Polypi frequently have their seat in the meatus, but since they more often accompany disease of the tympanum they will be treated of hereafter.

Sebaceous or molluscous tumours are enlarged sebaceous follicles containing scales of epidermis, which form occasionally in the meatus. If their progress be unchecked, they are apt to destroy life by causing absorption of the bone and exciting disease in the brain.* They may exist and even prove fatal in early life, though they are most frequent in the old. They are attended in their later stages with discharge and pain. The treatment would consist in laying open the swelling, evacuating the accumulated laminæ of epidermis by the syringe, and then withdrawing by means of a forceps the thick membrane lining the tumour. But when they are chiefly situated within the tympanum, the diagnosis is difficult.

Exostoses sometimes form in the walls of the meatus; they may grow from either of its surfaces, and cases are not unfrequently seen in which two or more of such formations approach each other towards the mesian line. The hearing is by no means always impaired in proportion to the closure of the canal; but when the occlusion is complete, which I have twice seen, the deafness is considerable. Cerumen or epidermis may accumulate behind these growths, and will then require great patience, and a persevering use of fluids adapted to soften the mass, in order to effect its removal. This form of exostosis may occur in comparatively early life. Treatment is not so inefficacious as might have been feared. I have seen a severe case, in which the application of tincture of iodine seemed to induce a diminution of the tumours, and improvement of the hearing. Mr. Wilde speaks confidently of the power of local depletion, counter-irritation, and mercurials to arrest their progress in arly stage, when there probably exists a chronic state of stitis.

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* Mr. Toynbee first described this affection, see *Med.-Chir. Trans.* vol. xlix. p. 51, and *Diseases of the Ear*, 2nd edit. supplement. Dr. Von Troeltsch believes the tumours are merely accumulations of secretion and not distinct growth I have met with them as small firm white bodies surrounded by a distinct membrane in cases in which there was no evidence of any large amount of secretion. See *Path. Trans.* vol. xvi. p 233.

III. Affections of the Membrana Tympani.

e membrana tympani is a thin colourless diaphragm, ched obliquely across the inner extremity of the meatus. s healthy state it is almost transparent; it reflects light gly, and owing to its peculiar curvature, presents a bright of triangular shape at its lower and anterior portion. This becomes obscured or altered in disease. Although the brane is freely permeated by blood-vessels, which become id in congestion or inflammation, and may give it a deep colour, none, or only a few small ones, are visible in its nal condition. Its external surface is concave, with the ption of a narrow ring around its border. For practical poses, the membrana tympani may be considered as con- ing of three laminæ—dermoid, fibrous, and mucous; each of ch may present distinct morbid conditions. The only guide hese is of course examination by the speculum. Inflation the tympanum through the Eustachian tube, may also be recourse to; certain effects of the pressure of air on the rnal surface of the membrane indicating tension, relaxation, dity, or ulceration of its layers.

n addition to the diseases which directly affect its own cture, the membrana tympani is often secondarily implicated norbid conditions of more internal parts, and its appearance give most important aid in their diagnosis. Thus in truction of the Eustachian tube the membrane is drawn ards, its natural concavity being increased, and the polish its surface diminished. Mucous or other accumulations hin the tympanum may, on the other hand, cause it to bulge wards; and the presence of an opaque fluid in that cavity may en be clearly recognised, through its transparent structure.

njuries of the membrana tympani.—This membrane is liable be ruptured from various causes, as the introduction of nted instruments, a fall, or very loud sounds, such as the losion of artillery, especially if occurring unexpectedly, so t the membrane has not been prepared for their reception by adjusting muscles. A box on the ear, of which no warning been given, will also produce the same effect, apparently by causing a compression of the air in the meatus, without the membrana tympani receiving the necessary state of tension. Sportsmen are liable to this accident from the report of their guns. Undue force of syringing, violent blowing of the nose, vomiting, paroxysms of hooping-cough, also have caused rupture of the membrana tympani; but in these cases there is little doubt that the membrane was previously weakened by disease. It may give way in death by strangulation. The symptoms of rupture of this membrane are pain, generally not severe, felt at the bottom of the meatus, soon followed by the appearance of a few drops of blood. The hearing is not necessarily impaired. If an examination is made shortly after the accident, a small clot of blood may be seen closing the wound, which is generally from a line to a line and a half in extent. In the majority of cases it heals speedily, and without any further symptoms. The clot falls in the course of a few days, but a white cicatrix is visible for long time. Occasionally, however, ulceration is set up, or small portion of the membrane seems to slough, the aper increasing in size for some days. In all the cases I have se however, in which the rupture has occurred in a healthy membrane, perfect repair has finally ensued, and without injury the function of the organ. In the treatment, it is for the part only necessary to guard the natural process of repair interruption. It may be advisable, however, if there be charge, cautiously to cleanse the meatus by the syringe. leech or two may be applied to the edge of the meatus if irritation be present and the orifice seem extending, or the ed of the wound may be lightly touched with nitrate of sil Indeed, under this latter plan, small orifices in the memb tympani, that have existed for some time, will someti heal.

Inflammation of the membrana tympani.—Frequently th epidermis covering the external surface of this membrane thickened and opaque, no other morbid condition being pres This is of no importance pathologically, but it is a freq cause of what is described merely as 'opacity of the membra tympani,' which in itself is of course not a cause of deafness Congestion of the membrane may arise from exposure to cold; it is attended with a feeling of slight uneasiness inside the ear, and sometimes with buzzing noises; and on examination en larged red vessels may be seen on the surface. Avoidance of ure, stimulating liniments, and warm oil dropped into the us, generally suffice for relief.

e *dermoid* lamina is subject to acute and chronic inflam- n.

te inflammation is not common as an isolated affection, t seems to occur sometimes from the application of cold or itating substances in debilitated constitutions. The symp- are pain, not very severe, generally attended with tinnitus some diminution of hearing. The surface of the membrana pani becomes of a red colour, large and distended vessels g visible; it appears swollen also, and there is sometimes ecretion from it of viscid mucus. I have seen small abscesses n in this layer of the membrane and heal without per- nent injury to the hearing. For the local treatment, one or leeches may be applied to the orifice of the meatus; gentle nging with warm water should be employed; and in the r stages mild astringents or a weak solution of the nitrate ilver may be had recourse to.

hronic inflammation of the dermoid lamina may remain as effect of the acute form; may arise from cold or other causes weak or neglected children; may supervene in the course of, after, the exanthemata; or may coexist with affections of the in in other parts of the body; or with inflammation of the atus. It occurs chiefly in the class of patients termed trumous,' and is said to have been observed to alternate with umous ophthalmia. It is attended sometimes with a rather pious mucous discharge, at others with an excessive secretion epidermis, which may accumulate in thick scales upon the rface of the membrana tympani, and give rise to deafness and eat irritation. These scales may be removed by syringing, , if difficult to dislodge, may be softened by the use of warm . or water. The membrana tympani in some of these cases comes greatly hypertrophied, and granulations of a bright-red lour, and easily bleeding, may form upon its surface. This ection is generally painless; but in the severer forms the aring is always much impaired. In the treatment, clean- ess should be maintained by the syringe, and the greatest tention paid to the state of the health, which will almost variably be found more or less deranged. In children, quinine, el, and cod-liver oil are almost always useful. Sponging, fric- n of the skin, and other points of hygiene, require attention; d with these, local measures may be combined. Vesication may be kept up, gently, behind the ear, and astringent lotions dropped into the meatus; or the membrane may be washed over with a solution of ten or twenty grains of the nitrate of silver to the ounce of water. But before having recourse to any topical applications, it is desirable to give cleanliness, combined with good general treatment, a fair trial. A considerable improvement seldom fails to ensue.

That inflammations of this layer of the membrana tympani are sometimes *specific* in their character, can hardly be doubted; but no distinctive marks of the presence of the syphilitic, or scrofulous, or gouty taint, have yet been pointed out in the diseased structures. The diagnosis must be determined by the history and the general condition of the patient. I believe also, that in all such cases the chief seat of the disease is in the deeper structures of the ear.

It often happens that after the removal of hard and adherent masses of epidermis from the meatus the membrane is seen to present a red and tumefied surface, generally at the upper part, from which no doubt the diseased epidermis is thrown off. The affection is of considerable importance, because though it readily subsides if the meatus is thoroughly cleared, and a solution of nitrate of silver applied, it may lead if neglected to the most serious consequences. An inflammatory swelling of the meatus may at any moment supervene, and extension of irritation inwards then becomes very difficult to prevent. I believe this condition may result from injudicious cleaning out of the ear.

The *fibrous* laminæ of the membrane appear to be subject to affections connected with a rheumatic or gouty diathesis; but in an acute form these are rare, and probably are seldom dissociated from general affections of the tympanum.

In *chronic* inflammation, the fibrous laminæ become thickened and hypertrophied, and the membrane presents a leaden appearance, often with congested vessels ramifying over its surface. The hearing is greatly impaired; which is less due, probably, to the condition of the membrana tympani, than to that of the lining of the tympanic cavity. The membrane may appear flattened, or if it retain its form and curvature, it is dense and rigid; and if the patient inflates the tympanum while the surgeon keeps his eye fixed on the membrane by means of the speculum, the natural yielding to the stream of air is not perceived. Pain is seldom complained of, but there is fre-a great amount of tinnitus. The treatment of both ffections is the same as for inflammation of the cavity mpanum. Mr. Toynbee recommends also the application urface of the membrane of a solution of the nitrate of en or twenty grains to the ounce), but the advantage of h applications needs further proof. In the entirely stage ether or sp. camph. ʒj. with liq. opii ʒss. in j. may give relief to the tinnitus.

is an opposite condition to which the membrana i is liable, and in which its fibrous layers seem to be concerned—that of *relaxation*. Patients come before us n the membrane has lost its natural regular form, and almost as if crumpled, sometimes falling in towards montory. In some of these cases the polish and transof the membrane are scarcely at all diminished; in t is opaque and dull, in others red and swollen. This tion' sometimes coexists with inflammation, at others s to be connected with an 'atrophy' of the fibrous which cannot always be traced to previous inflamaction; the scars resulting from previous loss of sublso generally appear as thinned and depressed spots. of these cases considerable deafness is present, which ed when the tympanum is inflated and the relaxed of the membrane put upon the stretch, but soon returns. se cases—*if the tympanum appears otherwise healthy*— astringent applications may be tried, and also the plan ended by Politzer, of retaining the membrane in its fter inflation, by closing the meatus air-tight by means g of cotton-wool rolled in wax, and worn for several tive hours. In a large proportion of these cases also ficial membrane, or a plug of cotton-wool moistened in e containing sulphate of zinc (gr. x.—xx. ad. ℥j.), answers o doubt by maintaining the ossicula in better positions. n the vast majority of these cases the chief seat of the is more internal; often the Eustachian tube is narrowed not necessarily occluded, or the results of old catarrh the tympanum remain in the form of collections of nucus, which demand evacuation by incision of the ne. This is still more apt to be the case in the conermed by Sir William Wilde, 'collapse' of the membrane, h its natural structure and position are altogether lost, ies more or less unevenly in contact with the whole of the internal wall of the tympanum, the stapes and incus forming more or less distinct projections. In some of these cases a persevering treatment of the Eustachian tube, by bougies, &c., and the thorough evacuation of all morbid contents from the tympanum, will lead to a truly marvellous restoration of hearing, but the patient should be warned of the tediousness and probable painfulness of the treatment and, in bad cases, of the uncertainty of the result.

Ulceration of the fibrous laminæ may occur, though not frequently, as a result of their continued inflammation. The dermoid layer of course partakes in the affection, and it is attended with a discharge from the meatus. It may either lead to perforation, or result merely in a thinning of the membrane, the mucous layer retaining its continuity. In the latter case the ulcerated surface appears depressed below the general plane of the membrane; it has an irregularly circular shape, and sometimes occupies a considerable extent. When the tympanum is inflated, the mucous membrane, lacking support, bulges at this spot, and may be distinctly seen to form a projecting sac. This condition seems not to be always accompanied with other disease, and is susceptible of benefit, especially if the ulceration be extending, by a weak solution of nitrate of silver cautiously applied to the surface; general treatment being at the same time adopted.

Calcareous deposits are frequently seen in the membrana tympani; they present chiefly two forms: either that of a small crescentic layer, evidently taking the course of the circular fibres; or that of an irregularly radiating mass, which has its seat amid the radiate fibres. These deposits are generally met with in cases of long-standing inflammatory disease, and then deafness is present; but they do not seem to be themselves any considerable impediments to hearing, since they are also seen in persons whose hearing power is scarcely diminished, and in whom the membrane itself appears to be in other respects in its normal state. Sometimes the degeneration affects the entire extent of the membrane, which is thus converted into a bony mass. But in these cases there is usually also extensive disease of the tympanum. These deposits consist chiefly of phosphate of lime. They are most frequent when the membrane is perforated, and a chronic inflammation of the tympanum has existed for a time; but they are by no means confined to the later perio life. In all these cases, any inflammation that exists ma combated by appropriate means.

some of these cases *incision* of the membrane will give
relief, alike to the deafness and to the tinnitus if any be-
nt, or if a simple incision be not sufficient, the *excision* of
iseased portion of the membrane—a proceeding first carried
y Dr. J. Gruber of Vienna—will often be very effectual. This
peration may be carried out by a simple knife, like a small
very thin-handled cataract knife, and a delicate pair of
d forceps. I have known not only the hearing greatly
ved, but very distressing sensations of oppression in the
immediately relieved by it. The only drawback is that
to the very strong tendency of the membrane to heal, the
is generally but temporary. To obviate this Dr. Adam
ser of Vienna has suggested the introduction into the in-
of a small vulcanite ring, grooved so as to remain *in situ*,
with a silken thread attached to ensure its not falling
he tympanum. That this procedure is efficacious to a
n extent I have proved; but my experience does not
e me to say whether a *permanent* benefit can be secured.
due precautions I have not found it give rise to irri-
l.

class of cases in which *incision of the membrane* is useful is
lt to define, and I confess that my own practice in this
t is as yet largely guided by theory. Where abnormal
on' appears to exist, it is reasonable to have recourse to
ther means fail, especially since it is very slightly painful.
ay be said to be wholly free from danger, either of exciting
ion or injuring the hearing. In some cases it appears to
vourably by diminishing such tension, as indicated by a
gaping of the wound. In others there is no such appear-
the edges of the incision remaining simply in contact;
n some of the cases in which the greatest relief has been
the membrane has appeared to be flabby and soft, even
extreme degree, cutting like a layer of soaked leather.
the very temporary nature of the benefit procured when
on is had recourse to except as a step to further procedure,
ly reduces its value.

rizzi's instrument for excising a circular portion of the
rane does not appear to have any special advantage over a
e double-edged knife, by which a portion can be excised if
d, or a crucial incision made and the edges turned back.
been proposed to obtain a permanent opening by induc-
lhesion of the edges of a triangular flap of the membrane

to the internal wall of the tympanum or the wall of the meatus.

Dr. Wreden, of St. Petersburg, has introduced an instrument, combining a small revolving blade and a forceps, by which the whole or the greater part of the handle of the malleus can be removed, together with the adjacent membrane. There is no reason to doubt that great relief is thus afforded in some cases; but whether it is permanent or not, does not yet appear. The method that seems at present to me most deserving of further trial is the 'ring' suggested by Dr. Politzer.

Perforation : the artificial membrana tympani.—The membrana tympani may become perforated in two ways: either by disease affecting the membrane itself, and usually progressing from without inwards, by ulceration of its laminæ, or much more frequently as the result of inflammation within the tympanum, causing accumulation of mucus or other morbid secretion within that cavity, which at length finds its way through the membrane into the meatus.

The diagnosis of perforation is generally easy. After the meatus has been cleaned out with warm water, the orifice may for the most part be very distinctly seen by the aid of the speculum. Or a peculiar pulsation (first described in this relation by Mr. Wilde) visible in the situation of the aperture, and probably due to the presence of a film or bubble of water, is very characteristic. If the Eustachian tube is not obstructed, the patient can blow air through the meatus with a prolonged whistling sound, which is perfectly diagnostic of the affection. If he cannot, it can generally be caused to pass by Politzer's method of inflation (see p. 287) or the Eustachian catheter. The aperture may be of any size, from less than that of a pin's head to almost the entire extent of the membrane. When the destruction of the membrane is considerable, the remaining portion usually presents a distinct lunated edge; and if the greater part is absent, the handle of the malleus, with a narrow strip of membrane on each side, is generally to be seen, either occupying its natural position, or fallen inwards. Sometimes this portion of bone remains with no membrane attached; sometimes the head of the malleus alone is left, and forms a prominent and characteristic object near the roof of the meatus. The border of the remaining portion of the membrane may be adherent to the promontory, forming a more or less completely closed cavity; and if by this means discharge is prevented from escaping, serious consequences may ensue.

Perforation of the membrana tympani produces, for the most part, a certain amount of deafness, though when the aperture is small and the ear otherwise healthy this is so slight as to be scarcely appreciable. In recent cases the closure of the orifice, if small, is always to be sought; the occasional application of a solution of nitrate of silver (℈j.—ʒj. ad. ℥j.) to the edges of the wound, and the subjugation of inflammatory action by appropriate means, will generally secure this result. In fact, the extent to which loss of the substance of the membrane may be restored, in the course of time, is very remarkable. I have now under my observation a child of twelve, in whom four years ago nothing of the membrane existed beyond a scarcely visible margin; the whole of the anterior and lower portions are now replaced by a distinct transparent layer, which the eye could not distinguish from the natural membrane, and which is thin inferiorly, and somewhat whiter and thicker anteriorly. There is every reason to believe that the restorative process in this case is not yet complete. It was treated by me by means of talc, as described hereafter. But almost always when the membrana tympani is perforated there exists a state of chronic irritation of the lining membrane of the tympanum, attended with either a constant or an intermittent discharge. On examination a fœtid mass of inspissated discharge will generally be found in the meatus, itself sufficient to set up inflammation; and on syringing this away the mucous membrane of the tympanum will be seen red, swollen, and velvety; often so thickened as to project almost to a level with the orifice in the membrane. In the treatment the chief point is to secure the perfect removal of the morbid secretion, which is apt to be extremely viscid, from all the recesses of the tympanum and Eustachian tube. In my opinion the difficulty of ensuring this is the sole cause of the proverbial tediousness and unsatisfactoriness of these cases. And, fortunately, the very existence of the perforation puts it in our power completely to evacuate the tympanum, by passing fluids, from the meatus inwards through the Eustachian tube. Above, and almost even in the place of, all other things, the treatment of chronic perforations of the membrana tympani should consist in first washing out the cavity by means of alkaline solutions passed from the meatus through the Eustachian tube into the fauces. This is not painful unless irritation exists (which should be, as far as possible, subdued), or the tub is closed, which then should be first rendered patent. It is ver simply done, and the only ill effect I have known ensue is temporary giddiness, lasting a minute or two. This giddine is, of course, much greater when the water used is too cool o too warm, but it will sometimes occur without any error o temperature. It affords no reason for modifying the treatmen An ordinary syringe suffices, a piece of india-rubber being plac upon the nozzle, so as nearly to close the meatus. When th surgeon has proof that the membrane is really perforated, an that the Eustachian tube is pervious, very considerable force, i it is necessary, may be safely used; and the stream will oft bring away enormous and almost incredible masses of more o less altered and inspissated secretion, with manifest improvement. The proceeding should be repeated as often as seem necessary, even for many weeks in some cases. I have know semi-solid masses of old offensive secretion to come away from a tympanum which had been thus treated, even after a stream of fluid had been several times passed through the ear without removing anything more than a few flakes of recent mucus; and my conviction is that in some, both of these cases and of those in which I am in the habit of incising the membrane with the view of thus washing out the tympanum, the mastoid cells and other recesses of the cavity gradually empty themselves beneath the influence of the stream; and that masses of half-dried mucus which have been accumulating for years may be thus dissolved and washed away. I believe that experience of the method could not fail at once to convince and to astonish every one who tried it. I use first alkalies—soda, or carbonate and chlorate of potash—in nearly saturated solutions, and afterwards employ for the most part alum or sulphate of zinc (gr. iv.—x. ad. ʒj.)

At the same time, if granulations are present, I apply caustics; generally either a strong solution of nitrate of silver, or, if a powerful action is required, chloroacetic acid; but chloride of zinc, also, is very effective—either may be applied by a camel's-hair brush.

Dr. Schwartze, of Halle, has strongly recommended, for the treatment of perforations when no granulations are present, solutions of nitrate of silver (from two to forty grains to the ounce). These he pours into the ear, and then, by means of a glass tube, made to fit the meatus by india-rubber, blows them through the Eustachian tube so as to reach the fauces. Immeiately afterwards he syringes out the ear with a solution of common salt, causing it to pass as far inwards as the caustic has done. The insoluble chloride of silver is formed, and comes away in large flakes. Excellent results, no doubt, are thus attained, but it is necessary to use caution, as the pain caused by too strong a solution is very severe. I should always postpone its use until after the ear had been repeatedly syringed *through*, as described above, with an alkali, and some mild astringent. Dr. Schwartze recommends it to be repeated daily for a few times, the discharge soon ceasing under its use in his hands. Another method of bringing about a permanent cessation of discharge when granulations are removed, or even before, is to employ talc (French chalk) in powder. All discharge being removed by syringing—for which purpose the patient should blow through the ear while the syringe is used—the surface should be thoroughly dried, as far as possible (lint rolled up, or the fringe of a towel, answer well). A little of the powdered talc should then be taken up in a small glass tube and blown into the meatus by a sharp puff. An elastic bag is preferable to the mouth. This should be repeated, if necessary, until the bottom of the meatus is well covered. The process should be repeated daily, and it is seldom that many applications are necessary; but the ear should be, each time, well cleansed and dried. I know no more effective plan than this, but it is somewhat tedious, and requires daily attendance, and is, therefore, naturally reserved for the more obstinate cases.

Of lotions I have found the perchloride of mercury the best as a general rule: a third of a grain to the ounce is almost always well borne; if stronger it is apt to be irritating. With it, as with every lotion, I combine opium or morphia, giving the preference to the tincture, from two to thirty drops. Of proper astringent lotions the sulphate of zinc (gr. ij.—x. ad. ℥j.) stands first; next to it the liq. ferri perchlor. (♏ x. ad. ℥j.); and then tannin (gr. x. ad. ℥j.). Whatever lotion is used, the patient should fill the ear, force air through the Eustachian tube freely, and let it run out, repeating this two or three times morning and evening. Syringing for himself is seldom useful, unless the patient can see the surgeon only at long intervals. The liquor plumbi is seldom advisable as a lotion in perforations, though it is often useful in granular conditions without rupture, and is very useful applied undiluted to granulations, or the roots of polypi growing from the edges of an orifice or the tympanic wall.

It sometimes happens that an orifice in the membrane is of too small a size to permit the complete escape of the discha In this case the irritation continues in spite of treatment, the membrane often assumes a red, and, in parts, gran aspect, and appears irregularly swollen. When air is fo into the tympanum it will sometimes escape through a mi orifice, bringing with it bubbles of air and mucus; at oth though it enters the drum, it does not pass through the m brane until a little viscid mass has been first protruded. have in some cases clearly seen two such minute orifices. treatment I employ, after a due trial of other means, is to enl the outlet by incision.

The most tedious perforations that I have met with are t which are situated at the anterior and lower part of the m brane, very near to the wall of the meatus. I believe the reas that the perfect emptying of the tympanum is more diff owing to the orifice being nearly in a line with the Eusta tube; so that the posterior part of the tympanum remains much a closed cavity.

The artificial membrana tympani.—To however grea extent the membrana tympani may be destroyed the he may suffer comparatively little, and with the treatment a described, it often happens that not only the discharge c and the exposed surface assumes a healthy aspect, but hearing recovers sufficiently for all the patient's needs. Sl this not be the case it is probable that there exists some re tion of the connections of the ossicula. In such condi astringent solutions, as sulphate of zinc, often produce temporary improvement, but the remedy is some form of ficial membrane — either the moistened cotton-wool of Yearsly, or the india-rubber disc or globe proposed by Toynbee. Each form has its special advantages, and a cas seems to demand it should not be abandoned till all have tried. For the cotton-wool I prefer glycerine to water, then will retain sufficient moisture not to need changi four or five days; and in most cases I add to the oun glycerine from five to twenty grains of sulphate of zinc.] rolled up into a small spindle-shaped plug, about half an long, it may be introduced either by a pair of force threaded through a narrow silver tube.* I think it is b t whatever form of artificial membrane is used towards the r and posterior part of the tympanum, so as to touch, if it esent, the head of the stapes. A little pain is sometimes lained of, but if the attempt succeeds well the patient is diately conscious of hearing better, and the cotton or disc ld then be left *in situ*, and the tube or forceps carefully lrawn. After a little instruction from the surgeon the nt soon learns to apply it himself, and if care is taken to nt accumulation of discharge or epidermis, the effect con- s indefinitely, and often becomes, even in cases of other- extreme deafness, so permanent as to render possible the ntinuance of the membrane. If the india-rubber disc is one made with a thread attached, and introduced by means tube, is preferable to one fixed upon a wire. Mr. Toynbee :—

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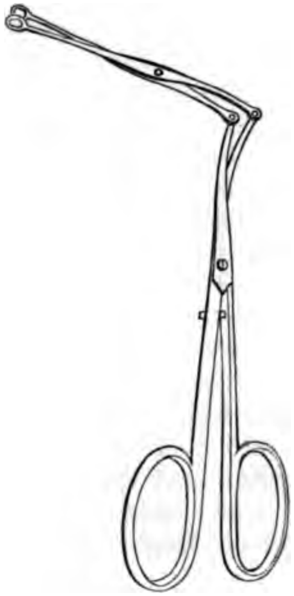
* Prepared cotton, &c., as also all the other forms of artificial membr sold by Messrs. Weiss, of the Strand.

> fter accurately noting the size of the inner extremity of the meatus to h the natural membrane was attached, the operator should proceed to cut rtificial membrane as nearly of the size and shape of the natural one as ble, taking care at the same time to keep the margin quite smooth and re- l. The patient should then be placed with the head inclined to the opposite lder, while a strong light is thrown into the meatus, which, if liable to rge, should have been previously syringed. The operator will next take rtificial membrane, and having moistened it with warm water, pass it, by s of the silver wire, gently inwards, until it has reached what he considers atural position. This he will ascertain by the occurrence of a faint bub- sound caused by the escape of the slightly compressed air beyond it: he lso feel a slight obstruction offered to its further passage by the remnant e natural membrane. Should any attempt be made to pass the artificial rane beyond this point, the patient will complain of pain, which up till had not been felt. The most certain test, however, of the proper placing e artificial membrane is the sensation of the patient, who discovers by the of his own voice, or that of the surgeon, or by the movement of his s and lips, that his hearing has been suddenly improved.'

is advisable, when there remains only a very narrow ring e natural membrane, to cut the artificial one a little larger, hat its edges may turn slightly backwards when it is intro- d. I have, however, sometimes found that a portion of brane cut to the shape of the aperture, but a little larger e, and applied directly to the ruptured spot, has answered er than when the whole surface has been covered. At first artificial membrane should be worn only for an hour or two, ven a shorter time, daily, and should be discontinued for a if any irritation arise. It should be removed at night.

olypi.—These growths may, for practical purposes, be divided into cellular and fibroid, according to the density of their structure, and the corresponding difficulty of eradicating them; some of the more dense of the latter also bleeding very considerably when removed. But minute examination reveals considerable complexity of structure in some of these formations, and there is an accumulating body of evidence that their structure varies definitely according to the surface from which they spring, and that those which arise from the meatus, or from the walls of the tympanum, possess a corresponding glandular structure which is wanting in those which spring from the outer surface of the membrana tympani. Their most frequent seat, in my experience, is the inner wall of the tympanum, the membrane being ruptured; but it is important to remember that they may form within the tympanum without the existence of any perforation. In this case they may either cause the membrane to give way, and literally grow through it, or at least appear to do so, or they may remain within the cavity, giving rise to great irritation, and require treatment by incision. In one such case (see *Clinical Society's Transactions*, vol. ii.) a polypus nearly as large as a pea was evacuated, with entire relief, having apparently become detached, and acting as a foreign body. Twice in post mortem examinations I have found small polypi growing from the *inner* surface of the membrana tympani. Next to the exposed tympanic wall the most frequent seat of polypi is the inner part of the meatus, and then the external surface of the membrane. Whatever their seat and nature they require essentially the same treatment, viz. the soothing of any irritation; the removal, as far as practicable, of all accumulated discharge; the eradication of the growth, and restoration to a perfectly healthy state, of the surface from which it sprang. For the first purpose, if any means are necessary, leeches, a few small blisters, and lotions of diluted liq. plumbi are the best; the second may be effected by syringing with alkaline solutions, forcing them through the tympanum if a perforation exists, and by the nose douche, or the patient drawing or syringing through the nostrils a solution of soda (gr. x. ad. ℥j.). For the removal of the polypus, if it be of any size, I prefer Sir W. Wilde's snare, armed not with wire, but with the gimp used by anglers. This is much less fragile less painful. The polypus may generally be thus cut th close to its root. When too small to be grasped by the s Mr. Toynbee's 'lever ring forceps,' consisting of two small by a movable cannula, or that here depicted, are both efficient. After a polypus of long standing has been ed it frequently happens that masses of old, half-dried, offen- ischarge are exposed, and may moved by the syringe, or the e is found covered with dense of epidermis requiring a pro- d use of alkaline lotions to them. When this is the case moval of the growth often gives to very distressing symptoms. after this has been done the treatment of the case commen- for, as the rule, no sooner is a us removed than it begins at to reproduce itself, and the only s that can be relied upon to nt this are to apply caustics, afterwards other astringent or g substances, *keeping the tym- sedulously free from collections ischarge*, until a perfectly healthy of the surface is induced. With- carrying this process thoroughly to a conclusion, to remove olypus, unless for temporary relief, is to inflict useless pain. plumbi, applied by a camel's-hair brush daily for a few before the caustic, greatly diminishes the pain. Chloro- tic acid, potassa fusa, carefully guarded, chromic acid, or oride of zinc, are good caustics. Nitrate of silver is excellent the later stages. The caustic is best applied daily until a ided effect is produced, this being by far the least painful and ious mode of using it. At the same time, a lotion of perchlo- of mercury (gr. ⅓ ad. ℥j.) with tinct. opii ♏v.—x. should be d twice a day; the Eustachian tube, if closed, should be made vious; and if the membrane be perforated, a syringing from meatus through the nostril practised frequently, as above cribed, unless it be contra-indicated. When the root of the ypus shows manifest signs of disappearing we can often sub- tute for the caustic the undiluted liq. plumbi, or the powdered a. By these means polypi of the largest size and most tinate character may, so far as my recent experience extends,

FIG. 148.



Forceps for extracting small Polypi.

always be entirely eradicated, and the tendency to their re
duction destroyed; or, if there be any exception, it is in some
cases of the densest and most vascular form of fibrous poly
in which the use of caustic results in a drying up rather th
total removal of the mass. The time occupied in the e
procedure varies from three weeks to three or four months.
is desirable not to commence it except with a thorough un
standing on the patient's part of its tediousness, and u
completed, its uselessness; but I have not known any one
persevered regret the trouble. The surgeon should reme
that these growths are very often, probably most often, mult
and this from the very commencement. I have syringed f
a child's ear four distinct minute polypi, each one evident
separate growth.

Instead of removal, injection into the substance of
polypus of a few drops of liq. ferri perchloridi has been p
tised with success, but I have not sufficient experience to s
positively of its results. Before removal the soft and sens
texture may be deadened by a few applications of liq. ph
in which morphia has been dissolved; and I have somet
caused sloughing of one of the softer kind, when removal
refused, by pressing into its substance a fragment of nitra
silver. But the pain of treatment by caustics, of course, gr
exceeds that of the snare.

Granulations on the surface of the membrana tympani ar
uncommon, either with or without perforation. Their t
ment is essentially that of the root of a polypus, but thei
sence almost certainly indicates disease within the tympa
the treatment of which is of the chief moment. Very frequ
the membrane demands incision.

IV. AFFECTIONS OF THE EUSTACHIAN TUBE.

The ordinary condition of the Eustachian tube, as show
Mr. Toynbee, appears to be that of closure by the apposit
its walls. It is opened by the tensor palati during the
swallowing, and probably at all times, when in a healthy
permits the gradual escape from the tympanum of fluids a
as of air. That it is not permanently open is shown b
effect of inflating the tympanum with closed mouth and no
the feeling of distension within the ear produced by whic
gradually subsides unless the act of swallowing be perf

hen it disappears at once. If this experiment be made by a ealthy person while the surgeon keeps his eye fixed upon the embrana tympani, that membrane may be seen to yield slightly the pressure of the air, assuming a less concave position, hich is retained for a time, even while the natural respiration carried on. If the act of swallowing be now performed, the embrane may be seen to fall back at once to its normal posion. Similar effects are said to be experienced during a descent a diving-bell. In addition to these facts, certain symptoms hich attend *an open condition of the Eustachian tube*, first deribed by Dr. Jago, of Truro, give evidence in the same direction. his affection is attended with a buzzing noise, and an unaturally vivid hearing of all sounds which have their origin in he patient's own mouth, throat, or stomach, to such an extent s greatly to interfere with the hearing of external sounds. here is at the same time a feeling of discomfort in the throat, which the patient endeavours to relieve by repeated acts of swallowing. The cause of this condition appears to be some tate of the throat, but of what character is not clear; perhaps ome irritation keeping the muscles attached to the Eustachian ube in a state of spasmodic action. The symptoms occur most requently during catarrhal affections. For the most part they are intermittent, the restoration of the natural apposition of the walls of the tube removing them at once.*

Much more frequent and more serious is the opposite affection, *obstruction of the Eustachian tube.* This condition may be due to various causes; thickening of the mucous membrane of the fauces or tympanum, or relaxation of the fauces, appear to be the most frequent. Stricture of the osseous walls of the tubes occurs sometimes, though rarely; firm membranous adhesions are occasionally found completely closing it, and accumulations of mucus no doubt have a similar effect. It is questionable whether enlargement of the tonsils can cause obstruction of the tubes. In reference, therefore, to the question of the removal of these glands in cases of deafness dependent on the condition of the throat, there seems to be no reason for departing from the rule that if their removal is desirable on general grounds, that is, if they are interfering with respiration and injuring the health, they should be excised, and not otherwise; unless, perhaps, in cases in which other means have failed, when the chance of benefit to the hearing may be weighed against that of injury to the patient from their loss. The slight loss of blood attending their excision may perhaps have a beneficial influence.

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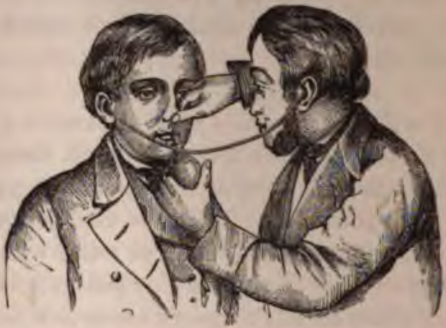
* It has been recently shown by Dr. Rüdinger of Munich that the Eustachian tube consists of two portions, the narrow and slit-like tube being seen, on section, to terminate above in a kind of hook;—*i.e.* a small circular canal runs along the superior border of the flat one. It has been argued that this is always open, but the question seems not practically important, the interchange of air by means of it being at least very slow. That there is a muscle which closes as well as one which opens the Eustachian tube is indicated by many phenomena of disease; perhaps especially by the effects of local irritants which tightly close it. phate of zinc *e.g.* syringed along it makes it for a time quite impervious. Von Troeltsch (*Archiv. für Ohrenheilkunde*, vol. i. p. 15) has argued from tomy that the tensor palati alone opens the tube, the levator serving to ose it.

The diagnosis of obstruction of the Eustachian tube may be made by inspection of the membrana tympani, and by the use of the otoscope. This instrument is a flexible tube, one end of which is to be inserted into the ear of the surgeon, and the other into that of the patient, while the latter, closing the mouth and nostrils, either makes a forcible expiration or performs the act of swallowing. If the Eustachian tube be pervious, the air will almost always be heard (after some practice) to pass into the ear during one or other of these operations. The sound that results when the organ is in its normal state is a peculiar *thud*, somewhat like the striking of a bullet against a target heard at a great distance, or like the blowing suddenly into a small bag of silver paper. When disease is present this sound may be variously modified; a creaking or whistling may be heard if the Eustachian tube be narrowed by thickening of its lining membrane; a 'gurgling' indicates the presence of mucus or other fluid within the tube or tympanum. It is seldom the case that if the Eustachian tube be pervious no sound is audible when the patient has learnt rightly to make the experiment; and if neither any sound can be heard nor any movement of the membrana tympani seen during the actions above described, and the other symptoms agree, obstruction of the tube may be confidently inferred. But the appearance of the membrana tympani also, in these cases, is very characteristic. Whether it be due to absorption of the air within the tympanum, when it is not freely renewed, or to any other cause, the membrana tympani always, when the Eustachian tube is perma closed, becomes more concave than natural, as if dra pressed in towards the cavity of the tympanum. It becom me time of a dull colour, and frequently somewhat opaque, ght spot on its surface being indistinct and diffused. This ion of the membrane may be distinguished from the re- of inflammation by the more decided concavity, without arity, and the absence of congestion or thickening. history also is characteristic of the disease. The deaf- s for the most part arisen gradually, without any con- ble amount of pain, and after repeated attacks of cold or hroat. Often the hearing will have been suddenly re- at various periods after a loud crack or report in the ear, radually lost again.

truction of the Eustachian tube from thickening of the mucous rane of the fauces.—This affection is more frequent before after middle age (the deafness of advancing years being connected with morbid conditions of the tympanum); and especially common in scrofulous or otherwise unhealthy ren. The appearance of these latter patients very often at betrays the nature of the malady; there is a fulness about ack part of the jaw, and, especially when the tonsils are enlarged, they have a peculiar expression of countenance, ng from the mouth being kept slightly open to aid in respi- on. They are also apt to snore when asleep. The deafness hese cases is considerable, the patient requiring to be spoken n a distinct voice within a yard or two. A 'stuffing' in the , and more or less tinnitus, are generally complained of. mucous membrane of the fauces is generally red and tumid. treatment indicated is to restore the health, to remove ections of mucus in the fauces, and to reduce the thickened mbrane. But besides these means it is desirable with very , if any, exceptions, to take advantage of a proceeding beau- l for its simplicity and invaluable for its results, introduced Dr. Adam Politzer, of Vienna, as a means of opening a closed stachian tube without having recourse to the catheter. king advantage of the natural opening of the tube during act of swallowing, Dr. Politzer suggested that air should forcibly blown into the upper part of the pharynx by the geon, while the patient swallows with closed mouth and e. This is very easily effected, either by means of an india- ber bag, or by a tube through which the surgeon may blow. st directing the patient to take a little water in the mouth, to swallow it with closed mouth at a given signal, the

surgeon next introduces into one of his nostrils the nozzl
the elastic bag (best ending in a piece of elastic tube), an
the same time that the patient swallows he forces the air po
fully into the nose. Unless the obstruction be very grea
air is almost sure to pass freely up the tube, and if the sur
uses an otoscope (a simple piece of elastic tubing eigh
inches long is the best) he will hear it enter the tympanum

FIG. 149.



Politzer's method of opening the Eustachian tube.

loud clapping sound is sometimes heard, and is almost a c
indication of a restoration of the hearing; at other time
sounds are obscure or decidedly *moist*, indicating fluid
the tympanum, and the effect is slighter, or null. These
belong to disease of the tympanum. If on the other ha
only or chief abnormal condition has been the closure
tube the effect is most striking, and to the patient often
startling. In confirmed cases it is desirable to repeat thi
ceeding more or less frequently, and it often suffices, com
with general treatment; and especially with the use of
tion of soda or common salt, drawn or syringed throug
nostrils, as before described. For bracing up the thic
membrane, I prefer to nitrate of silver, &c., dried alum pow
and blown into the angle behind the tonsil through a
glass tube. An adult can quite easily draw in the
for himself, by *sucking* through the tube. The alkaline
tion through the nostril, combined with the powdered
thus applied, is a very efficient plan of treatment.
times, but rarely, a leech or two applied beneath the ea
by means of a tube, to the nasal mucous membrane
affected side, or in both these situations at once, are de

the commencement of the treatment. Stimulating and ringent gargles or inhalations may also be used if necessary. ctions around the throat, either with salt and water or with mulating liniments which may contain salts of iodine, will of rse be recommended, together with ample exercise in the en air, and cold or tepid sponging. Tonics are often indi- ted, especially in children; the acid mixture of iron and lphate of magnesia is the form that I prefer. The Eustachian be may also be obstructed by thickening of the membrane ing its tympanic orifice, as a result of chronic inflammation thin the tympanum.

Relaxation of the mucous membrane of the fauces will also pro- ce closure of the Eustachian tubes. This condition is different om that of thickening, and occurs in a different class of tients. It is met with only in adults; chiefly in persons in eak health, and suffering under general relaxation of the stem. Those who smoke to excess are especially liable to eafness from this cause. The lining membrane of the throat pale and mottled, the uvula is elongated. The membrana mpani presents the characteristic dull and concave appearance. eneral bracing and tonic measures, with stimulating and as- ringent applications to the fauces and the orifices of the tubes, nd the abandonment of any practices injurious to health, will ffect a cure.

The Eustachian tube may also be obstructed by stricture of s bony walls. Two cases are reported by Mr. Toynbee. The ame effect may be produced by effusion of fibrine uniting its urfaces by firmly organised tissue. In such cases as these he chief point would be to make an accurate diagnosis, and o avoid subjecting the patient to useless treatment. The xploration of the canal by an elastic sound would of course be ecessary.

Among the rarer causes of obstruction of these tubes may be entioned, on the authority of Sir W. Wilde, foreign bodies; the most remarkable case on record is that in which an ear of arley was discovered after death projecting from its guttural rifice.' The same author also mentions that he has seen deaf- ess induced by a large fleshy nasal polypus, which passed own into the pharynx.

In cases in which the obstruction of the Eustachian tube will ot yield to the means prescribed, recourse must be had to the *ustachian catheter*, the use of which is happily, as a rule, free alike from pain and danger. The patient being placed in easy posture, the surgeon, standing on his right side, sh take the catheter lightly between his finger and thumb and p it gently along the floor of the nostril until it reaches pharynx. At this point either of two methods may be adop for conveying it to the opening of the tube. It may be car on, its point still turned downwards, until it reaches the p terior wall of the pharynx, and then it may be drawn forw about half an inch, being gently rotated at the same time o wards and upwards. In doing this it will for the most p easily slip into the trumpet-shaped orifice of the tube, and m be felt to be embraced by its walls. Or when the point of t catheter has arrived at the posterior nares, the instrument m be gently rotated outwards and slightly upwards, and car on into the pharynx. In this way it may be passed dire into the Eustachian tube. The former plan, however, is t easier; and in the latter it is necessary to guard against e tangling the point of the catheter in a lacuna which lies direc in its route. No bleeding should follow its use, unless th has been unusual resistance. Air may now be passed into th tympanum, either by an elastic bag or by means of a flexi tube, provided at one end with a mouthpiece, at the other wi a small pipe fitting into the end of the catheter. The otoscop being placed, one end in the ear of the surgeon, and the oth in that of the patient, the air, if it can be forced through th Eustachian tube, may be heard to pass into the tympanum an strike on the membrana tympani. The chief sources of failur in passing the Eustachian catheter are two: first, suffering th point of the instrument to slip up into the *middle* meatu instead of sliding along the *floor of the lower*; and secondly not drawing it far enough forward again after touching th posterior wall of the pharynx. In other words, if the instrumen is wrongly placed, its point will generally be either too hig up or too far in. Sometimes it happens that it slips som distance *down* the pharynx before being stopped by conta with its posterior wall, and in this case requires more than t average withdrawing; the distance between the orifice of t tube and the back of the pharynx is perceptibly greater in m than in women. Besides its use in closure of the tube, t catheter is constantly in requisition for the efficient diagno and treatment of disease within the tympanum, and facility its application (which is not difficult) is indispensable to ish to be able really to relieve this class of affections. A ittle practice on the recent section of a skull gives all the hat is needed. The best form of catheter, I believe, is that ucted of vulcanite; various sizes and curves are desirable—tter ranging from a very slight bend of the point to nearly icircle of an inch in diameter, for using through the ite nostril in case that on the affected side should be vious.

e only proofs that the catheter lies fairly in the tube, are ng the air pass along the tube, or introducing a bougie, or ving its position by means of rhinoscopy. The latter, ver, is seldom required, although an examination of the rior nares and orifice of the tube by means of the mirror has d, and will no doubt add more, to our knowledge. It has ited, for example, ulcers of the mouth of the tube and stations of thick mucus over it, necrosed conditions of the ent bone, and complete obliteration of the orifice.

air cannot be passed into the tympanum by means of the eter, the tube may be opened by bougies. This proceeding tended with a certain amount of pain, but with due caution free from serious danger, and by means of it very many rwise incurable cases of deafness may be perfectly relieved. remarkable, indeed, how dense, and how confirmed strictures e tube may by perseverance be thus thoroughly and perently overcome. Often, indeed, one, or at most three or , introductions of a thin and very elastic bougie will suffice; in other cases I have known a perseverance in their use, nding over many months, completely successful at last, and ing restored with almost absolute perfection, where it had absent for twenty years. In this case there existed also a ection of mucus within the tympanum, for which the meme had been incised more than once, with only temporary efit. When a stricture of great density exists, it is requisite ave recourse, very carefully, to whalebone bougies, and to inaria, which may be suffered to remain in the tube five or minutes, the catheter and bougie being then withdrawn ther. Two cases of laminaria bougies *breaking off* in the , are recorded by a German physician, but the fragments came away, leaving no ill effects. I have never found such ccident in the least degree threatened. But even in spite are, slight abrasion of the mucous membrane will sometimes ur, and then if air be forcibly injected it becomes extravasated in the cellular tissue, and causes a swelling which naturally alarms the patient. With the least prudence, however, this accident is never formidable. The air is entirely absorbed in a day or two, and after a fortnight's rest, the treatment may be quite safely proceeded with.* An excellent addition to the use of bougies is to introduce through the ordinary catheter another very small elastic one (capable of entering the tympanum through a normal tube) as far as it can be passed, and then to syringe through it, with moderate force, a strong alkaline, or weak caustic solution—using as it were hydraulic pressure. The inflation by Politzer's bag should be used concurrently; and by degrees a stricture that at first seemed hopeless will yield. When air has at length reached the tympanum, a few drops of a solution of nitrate of silver (gr. ij.—vj. ad. ℥j.) should be carefully syringed into it, and this may be repeated at intervals of two or three days if necessary, and if no severe pain ensues. The tube after a time remains pervious. In bad cases a daily introduction of the bougie is required; but it is needless to say that—unless in exceptional cases—neither this nor any other severe or prolonged treatment to the tympanum should be carried out unless the symptoms indicate that the nervous function is tolerably well maintained.

In syphilitic affections of the throat the Eustachian tube will sometimes become obstructed, but apparently much less frequently than might have been expected. Such cases seem to do perfectly well under a rational combination of the general and the local treatment.

V. Affections of the Tympanum and Mastoid Cells.

During the last few years considerable light has been thrown upon some of the affections of the tympanum. Among other points the diagnosis between deafness depending upon tympanic or nerve lesions has been greatly advanced. The chief means of distinction is the tuning-fork, used in certain ways, the only drawback to its value being the fact that a certain mber of persons, otherwise of good hearing, are unable, or most so, to hear it when placed upon the head. Allowing for s circumstance, which is not often of consequence, the follow- g propositions may be laid down:

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* It is my impression that a case of death after using the air-press, which made a great sensation in London some thirty years ago, and helped to throw Eustachian catheterism into very undeserved ill-repute, was due to extr air obstructing the larynx; but this cannot be made certain, and the proves that the air was injected in a most rash and violent way, and ap was entrusted to hands quite unskilled.

1. That in a normal state a tuning-fork is heard before e meatus after it has ceased to be heard on the vertex.

2. That when placed on the vertex, it is heard more plainly en the external meatus is closed.

3. Consequently when one meatus alone is closed, the tuning- rk is heard most plainly in the closed ear.

The reason of this fact appears to be, that the sound escapes eely through the tympanum and meatus, and that when its ssage is impeded the waves are reflected and affect the laby- nth more strongly. Consequently in cases of disease the llowing inferences seem justified:

1. In cases of one-sided deafness, if the tuning-fork, when laced on the vertex, is heard most plainly in the deaf, or more eaf ear, the cause is seated in the conducting apparatus; if it is eard loudest in the better ear, the cause is probably in some art of the nervous apparatus.

2. If, on closing the meatus, the tuning-fork is heard de- idedly louder, there is no considerable impediment to the assage of sound through the tympanum.

3. If the tuning-fork is heard longer on the vertex than when placed close before the meatus, the cause of the deafness is in the conducting media.

4. However imperfectly the tuning-fork may be heard when placed on the vertex, it gives reason for suspecting only, and is not proof of, a nerve-affection.

Other conclusions also may be drawn from the use of the tuning-fork, but they are either corollaries of the foregoing, or are too doubtful to be of real value in practice; but those mentioned are of the greatest and most constant practical value. With few exceptions they enable us at once to distinguish between an affection of the receptive and of the conducting portions of the organ; and thus relieve us entirely from that which has been the great difficulty and discouragement in the treatment of diseases of the ear. I find it a good routine plan of examination to note in respect to the hearing, (1) the distance by the watch; (2) whether watch heard on head; (3) how long the tuning-fork is heard on the vertex—whether equal or not to some average standard, the surgeon's own hearing of it, for example; (4) whether the sound is heard alike on both sides, or on which side it is louder; (5) the effect of closing each meatus; (6) whether it is louder on the vertex or before the meatus. If the deafness is considerable, and the tuning-fork indicates a normal condition of the tympanum, as *e.g.* that it is heard longer before the meatus than on the vertex, that its sound when on the vertex is increased by closing the meatus, and that it is heard best on the less affected side, I infer a 'nerve' affection. I have not found that the age of the patient materially affects these conclusions. Of course when thus assigned to the nervous system, the real nature of the affection remains altogether to be investigated, and it may in many cases have its real seat in parts altogether distinct from the ear, or in the tympanum itself, the impaired function of the nerve being entirely secondary.

The chief diseases to which the tympanum is liable are inflammation either of its mucous membrane or osseous walls, and the results of such inflammation, in the form of effusions or adhesions; rigidity of its lining membrane; deposits within its cavity or that of the mastoid cells; anchylosis either of the ossicula to each other or of the base of the stapes to the fenestra ovalis; and disconnection of the ossicula from each other, with or without caries.

Acute inflammation of the mucous membrane of the tympanum.—This affection may exist in very various forms, from that of a slight degree of pain in the ear and deafness, rapidly subsiding, to that of a most severe and dangerous disease. It may occur in apparently healthy persons, and is then generally attributed to cold; it often accompanies an attack of catarrh. The mildest forms, which might perhaps be distinguished under the name of congestion, are characterised by an aching pain felt deeply within the ear, and for the most part by noises of a buzzing character; the hearing is impaired, but less in first than in subsequent attacks. The membrana tympani may be found on inspection slightly vascular, and either retaining its transparency, or dull; the meatus is healthy. Inflammation of the tympanum is rather painful; the air enters naturally, or with a slight creaking sound. This affection becomes of serious consequence by recurrence; for though the attacks may s subside, a repetition of them seems to be a frequent caus confirmed deafness, probably by producing thickening rigidity of the delicate mucous lining of the tympanum. T

morning. Habitual cold sponging and friction,
around the ears, should be recommended to patients
is affection; and care should be taken to keep the
healthy state. It is desirable to pay especial atten-
ventive measures in all these cases, since they present
f the most common and most baffling forms of deaf-
e very process of its formation. It would probably
l plan, if such patients inflated the tympanum with
ur every evening for some days after an attack; and
tient nor surgeon should be content unless the full
aring power be regained. It is very seldom that
ffering under deafness care to continue treatment
ng is complete, since a certain imperfection occasions
nience; but such cases as these might well form an
to the rule.

n proportion of these cases no doubt result in the
ion of mucus within the tympanum, as referred to

erer forms of acute inflammation of the mucous
of the tympanum are attended with intense pain, of
g, darting, or bursting character, extending over the
head, often in the course of the nerves, and aggra-
wallowing or any other motions of the throat. There
and distressing noises, and the hearing is always
paired; much fever too is present, and delirium often
These symptoms may either commence suddenly.

transparent laminæ. The throat is almost always actively inflamed. The act of inflating the tympanum, or of swallowing with closed mouth and nose, is acutely painful; if air enters the tympanum, the sounds are a gurgling or a prolonged creaking. There is often great tenderness over the mastoid process and immediately in front of the tragus. The treatment is that which is indicated by the pathology of the disease. In the most severe cases venesection is recommended by some authors, or cupping behind the ears. Leeches freely applied around the ear, and at the same time, perhaps, to the nasal mucous membrane, give great relief; and these may be repeated if the severity of the symptoms does not abate. Fomentations, steaming, and poultices, with all of which sedatives may be combined, and which the feelings of the patient demand to be used very hot, may be constantly applied; while aperient and cooling medicines, and morphia, or morphia combined with hyoscyamus, &c., in full doses, to procure sleep, may be administered. Some cases will improve rapidly under remedies of this kind: in others the symptoms are more obstinate, and all authors unite in recommending the administration of mercury in the form of calomel and opium; a point on which I can offer no opinion, not knowing any evidence by which the comparative progress of the disease, when these remedies are given or withheld, may be tested.

After a few days the severity of the pain generally diminishes, and in the most favourable cases the disease terminates either in resolution, or, when the secretion has been but slightly increased, in discharge through the Eustachian tube. In the latter case, the passage of the matter into the pharynx is often felt by the patient, and indications of it may sometimes be seen by the surgeon. When either of these events occurs—the resolution of the inflammation, or the discharge of matter by the Eustachian tube—the symptoms gradually subside. In time the organ may perfectly recover its normal appearance and function, though it is generally several months before the restoration is complete. Continued stimulation around the ear, and inflation of the tympanum with steam containing the vapours of iodine, acetic ether, &c., may perhaps expedite this process. The use of alkaline solutions through the nose is almost always of value.

In another class of cases, the matter discharges itself through the membrana tympani. This also may result in perfect re-ration. The ear should be kept clean by the free use of tions, either alkaline, or of perchloride of mercury, or in e later stages of sulphate of zinc, used as before described. ild counter-irritation may be perseveringly maintained, and nics, and possibly iodide of potassium administered, the neral and local hygiene being also assiduously attended to.

A case is related by Triquet of acute inflammation within the mpanum arising upon the disappearance of an eczematous fection of the skin. A blister was applied to the nape of the eck, and the blistered surface became the seat of a similar ruption, on the access of which the aural disease subsided. cute inflammation of the tympanum may run on to caries of he bone, and secondary intracranial disease; but such effects re far more frequent in the chronic form of the disease. Para-ysis of the portio dura nerve may also accompany it: but this omplication does not generally require special treatment. When it remains after the aural inflammation appears to have een cured, galvanism is said to have been found useful; but a horough examination of the tympanum should be made.

Accumulation of mucus within the tympanum.—This is one of the most frequent forms of disease of the ear, and in its after consequences I am convinced one of the most frequent, and most irremediable causes of deafness. Happily it is, not only in its earlier stages, but even after it has existed for years, entirely curable, by the incision of the membrane and washing out the abnormal contents of the tympanum. When the shape and relations of this cavity are considered, and that it is subject to the very same affections as the adjacent mucous surfaces, it cannot be matter of surprise that under a great variety of circumstances collections of viscid and tenacious mucus should form in it, that can by no possibility escape by the Eustachian tube. Indeed, these aggregations of mucus are often so dense that they do not even gravitate to the lower part of the cavity, but cling about the heads of the ossicula, and cause the membrane to bulge or to become atrophied at the upper and posterior part. At other times they consist of a very thin fluid, which moves freely in the tympanum, and may be seen through the membrane to shift its position with the motions of the head. The patient will often complain of distinctly feeling something moving in the ear, and will acquire the habit of giving the head a peculiar shake with the view of moving it. In some cases I have found the collection to consist of two distinct portions—a thinner, escaping freely on incision of the membrane; and a thick tenacious residuum, the evacuation of which is a matter of considerable difficulty.

The most frequent cause of the condition is a severe attack, or repeated slighter attacks, of a common cold, and though it is by far more frequent in the young, it may exist at every age. In one patient of sixty-seven, incision of the membrane and evacuation of a tenacious matter gave satisfactory results. After the affection has continued for some time, the membrane becomes considerably changed; apparently from the pressure of the fluid, it loses its elasticity, and becomes thinned in certain parts, especially in the region of the stapes; and as the Eustachian tube is almost always closed, the membrane is often irregularly drawn in—in some cases even lying in contact with the inner wall of the tympanum, at other times it distinctly bulges, and generally, though not invariably, the light yellowish colour of the mucus may be discerned through it. Sometimes bubbles of air may be seen outlined on the inner surface of the membrane. The diagnosis is generally easy, and is made chiefly by inspection of the membrane and inflation of the tympanum, either by the patient himself, by Politzer's process, or by the catheter; the air entering the tympanum with a distinctly moist sound, of various kinds. When the affection is in its first stage the membrane is red and vascular, often bulges considerably, and pain is present. The 'Ear-ache' of children, followed by discharge, even though it is slight and very soon over, I believe, is most frequently an affection of this kind. I have seen under such circumstances, a minute opening form in the membrane, discharge for three or four days, and close.

In quite recent cases the symptoms may entirely subside, the excessive secretion appearing to be gradually absorbed or escaping by a small orifice through the membrane, under a treatment consisting merely of general management combined with counter-irritation and washing out of the throat; but even in these, the question of incising the membrane, with a view either to save it from extensive ulceration or to guard against future obstruction of the tympanum, is one deserving careful investigation. But in confirmed cases, where there exists no inflammatory action, but merely a chronic or intermittent deafness, with liability to repeated colds, the one treatment that it is rational to apply, or that yields any permanent success, is to incise the membrane, and by a free stream of liquid, as described under 'Perforations of the Membrane,' p. 278, thoroughly to cleanse out the tympanum. In a word, the case should be converted into one of perforation, and treated on the same principles. As a rule, the incision heals, even if it be syringed through daily, in four or five days, nor is it desirable to attempt to keep it open longer. Very often, however, more than one incision is required, and the amount of dense mucus that may be thus removed, even in cases where there has been no indication of any very excessive quantity, is often truly surprising, and can only be accounted for by supposing that it has been crammed into the mastoid cells and gradually makes its escape as the tympanum is cleared. It may sometimes be seized by a forceps, as it protrudes from the orifice after inflation of the tympanum, and drawn out as a viscid mass into the external meatus. I have removed in this way a mass twice the size of a marble, and with immediate, and so far permanent, restoration of the hearing, in a case of continually recurring deafness extending over five years. Many of these cases may be temporarily greatly relieved by the inflation of the tympanum and other means, but they relapse again and again, and lapse finally, in my belief, into confirmed deafness, constituting, *e.g.*, probably the larger part of the cases of 'thickening of the mucous membrane of the tympanum,' and no inconsiderable section of those of 'nervous deafness.' The great importance of a really rational treatment of these cases lies, of course, in its prevention of incurable consequent mischief. The tendency of these mucous accumulations is to become more and more dry and tenacious—they may be traced, indeed, through stages of this drying process—until they come fatally to clog the passage of sound. And they appear to work more disastrously still, by exerting an influence upon the labyrinth, and destroying by degrees the perceptive as well as the conductive power of the organ. It is my belief that if this affection were always rightly treated in its earlier stages, at least a third of the cases of confirmed deafness would be averted.

In its later stages, when the mucus has become dried, the diagnosis is much more difficult, and indeed it must rest largely on the history and on general inference. The appearance of the membrane, however, is often a very considerable guide; a general whiteness, *e.g.*, or especially a white streak posteriorly, or a rim of white thickening at the upper part. In many of these cases, considered hitherto as 'thickening,' I have found the incision of the membrane, and washing out the cavity, great service, especially if it is first prepared for by the repea injection into it of solvent liquids, as described hereafter.

The mode of making the incision is very simple. I use very small double-bladed knife with a thin handle, and ma the incision (unless a special bulging indicates another sp always behind and parallel to the malleus, between it a the incus, and carry it from near the upper border to near th lower. I seek especially to open the upper and posterior part the tympanum, because I am convinced that it is there especia that the more viscid class of secretions chiefly collect, and it there also that they are most mischievous. If the knife do not penetrate too deeply, there is no danger of dividing th chorda tympani. Once only have I noticed any symptoms d to this cause, viz. a tingling running down to the tongue duri the incision, and a marked diminution both of taste and general sensibility of that side of the tongue, passing off in few days. In this case, however, a good deal of pain was com plained of after the incision. I have said the incision heals i four or five days, and this is the case unless irritation shoul set in, as occurs now and then, in which case the healing i delayed perhaps for ten days or a fortnight. On each of th four days subsequent to the incision, if no irritation arises, I syringe a strong solution of soda through the tympanum by the meatus. On the fifth day the orifice is generally closed, but i it be not I suffer it to heal, and repeat the incision at the interval of a week or more if its repetition is indicated. Generally, if the case is a suitable one, an immediate improvement occurs. Sometimes the contrary is the case at first, even when the ultimate result is most satisfactory. Sometimes, of course, no benefit has ensued, and the hearing has been for a time considerably impaired; but I have not yet met with a case which I have been able to keep under observation, in which th original condition has not been after a few months complete regained. The proceeding itself, with care, seldom seems to giv any shock to the system: once only, in a child who had suffere from convulsions previously, did convulsions follow shortl after the incision of both membranes.* But I have fou that whenever any decided treatment is used to the tympanu a certain number of cases the *meatus* becomes inflamed. his, though it exerts no injurious influence on the progress of e case, is exceedingly painful and discouraging. I know no y of avoiding it but great caution in the applications, nor es this always succeed. The pain subsides in a few days. Hot ppy fomentations, warm lotions of liq. opii sed. (♏ v— ad ℥j.), and ointments containing aconite, give most relief. n incision through the inflamed structures down to the ne, especially of the superior or posterior walls of the meatus, t only gives immediate relief to the pain, but is of great rvice to the original disease, especially when there have exted symptoms of cerebral irritation.

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* As an universal rule I apply any powerful local treatment only to one at a time, and to the worse first.

For this method of treatment is of eminent use in a large umber of cases in which general nervous derangement has -existed with obscure feelings of distress connected with the ar and head. In such cases, if an excess of mucus exists ithin the tympanum, the evacuation of it often gives the reatest relief. And I have found, both in these and in other ases, the membrane extremely dense and resisting to the knife, howing that it had offered, through the effects of disease, an nnatural resistance to the escape of the retained secretion. This condition of the membrane appears to be scarcely less frequent in young children than in adults.

It is probable that not a few cases of incomplete deaf-dumbness originate in disease of the tympanum, attended with such hyper-secretion. Nor does it seem unreasonable to hope that a practice founded on this belief, and not too long delayed, might here and there, where the symptoms and history suggest this cause, yield satisfactory results.

The incision of the membrane is not usually severely painful; in some cases it is scarcely painful at all; in others it gives rise to feelings of sickness and prostration for a few minutes. If the membrane is inflamed and tender, however, it is acutely painful for the moment. The patient should be prepared to keep the head resolutely still for the few seconds the incision demands, but it should not be fixed, lest not being able to move *away* from the surgeon's hand, he should suddenly move towards it. This is a precaution I employ in all operations in the immediate vicinity of the membrane. In children anæsthesia is desirable. The nitrous oxide produces an amply long effect, but the child is apt to be restless under it. Chloroform induces a more perfect stillness, and the syringing through the ear may be carried out before recovery. It is needless to sa that any blood should first be carefully syringed out of th meatus. I generally advise a lotion containing soda and liq opii to be poured (warm) into the ear twice a day until healing has taken place. If any irritation of the meatus exists, it i desirable to subdue it before making the incision, or at least to proceed very cautiously afterwards.

A peculiar inflammation of the tympanum also accompanies various febrile diseases, especially the zymotic diseases of childhood. In scarlatina it is especially frequent, but it occurs also in measles, and in hooping-cough. I should suspect that it was common in croup, since in two fatal cases of that disease, which I examined, it was present in both. The tympanum becomes filled with pus or puriform mucus; its mucous membrane thick, red, and velvety, often so swollen as almost to fill the cavity, and it easily peels off from the bone; presenting in all these respects a marked contrast to its properties in health, when it is so thin and delicate as scarcely to be recognisable, and adheres with unusual firmness to the osseous walls of the cavity, to which it serves as a periosteum. The mastoid cells generally participate in the disease, and are also found full of fluid.

One peculiarity of this class of affections is, that they are apt to excite no attention. It is seldom that any indication, at least any one that would be observed by a person not on the watch for it, is given of the inflammatory action within the ear; and the first symptom that is noticed is a discharge from the meatus, which occurs, for the most part, only after irreparable injury has been done. Should it not, therefore, be a rule with the medical attendants of children suffering from any of this class of diseases to prove the absence of this affection of the tympanum, by examining the membrana tympani with the speculum and lamp, instead of assuming that it is not present unless palpable symptoms force it upon their notice? Such an examination, it seems to me, should be held imperative, at least in every case in which anomalous symptoms arise, and the patient's general condition seems worse than the progress of the disease might have given reason for expecting. The appearance presented by the membrana tympani is quite sufficient to determine the presence, the nature, and even the stage o the disease. The inflammatory action commencing *within* th tympanum, the external layers of the membrana tympani retai their transparency, and permit either the opaque fluid or t ened and congested mucous lamina of the membrane itself clearly distinguished through them. This is an appear- which, once seen, can hardly be mistaken. In the early of the affection the membrane presents an increased con- ty, owing, I presume, to closure, by thickening of its lining, he Eustachian tube ; and there is often no other alteration ts appearance, except a bright pink colour seen *through* it. he later stages the membrana tympani grows flat, it is dull sodden in its hue, and at length manifestly bulges outwards re the accumulated secretion. The treatment would be led by circumstances. In the slighter cases it might be ible, by antiphlogistic means, to subdue or check the local mmatory action. In patients prostrate from severe scarla- or the like, it might be hopeless to attempt this, but llent results might probably be expected from incision of nembrane. If, as in a case mentioned by Abercrombie, a harge of matter from the ear restored to health a woman had lost consciousness, might it not preserve from death a l depressed already to the lowest point by the poison of atina? Might not such a patient's tenderer brain and er powers succumb entirely to a source of irritation which l produce symptoms so grave in an adult unaffected by r disease? I do not hesitate to avow my conviction, that prompt attention to the condition of the ear, and prompt uation of pus from the tympanum when evidence was given s presence there, the balance might often be turned between nd death, and the mortality from scarlet fever and the d disorders notably diminished. What else does the follow- report indicate?

girl, aged eight, died in convulsions after scarlatina. No important disease found, but the tympanum on each side was full of purulent matter, the ranæ tympani slightly bulging. It is true the urine was albuminous; but not so in very many cases of scarlet fever that recover? There was no ed disease in the kidneys. A case is reported by Mr. Harvey,* in which vacuation of matter from the tympanum in acute scarlatina seemed to be ded with the best results. I have met with a case, a child aged five years, had been deaf since the measles, two years before, in whom a mild attack of tina very considerably improved the hearing. The membranæ tympani in se were normal. In another case, of chronic deafness in a man aged thirty, tina produced a similar effect.

eafness often supervenes in the course of typhus or typhoid fever. In some of these cases it seems to be due to a pec form of inflammation of the tympanum. The cavity bec the seat of a sanguineous effusion, which is found after d either in a fluid or coagulated state. The mucous memb seems at the same time disorganised, and the osseous walls be soft and infiltrated with red fluid. A considerable pr tion of the cases of confirmed deafness met with after feve probably of this kind; but not all of them. For some the tympanum is found quite healthy, and the cochl vestibule, or both, contain an effusion of bloody fluid ; some no appreciable alteration of any part of the organ is though the loss of hearing has been complete.

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* *The Ear in Health and Disease*, p. 101.

A collection of puriform mucus is found so frequen infants after death, that it seems to have given rise opinion that the tympanum, during the first period of naturally filled with mucus, and that children only be gain the faculty of hearing about the third month. I hav vinced myself, however, by repeated dissections, tha tympanic cavity is, in the healthy state, quite free from and that the membrane lining it is thin and delicate, very earliest periods. But in a large number of ch especially those suffering from other affections of the m membranes, and particularly of the lungs, the lining mem of the tympanum is thick, red, and soft, and the cavity is with mucus, often of a purulent character; the Eustachian by reason of its thickened lining, being impervious to the The condition, in short, precisely resembles that which in scarlatina, except that it is less intense and comes rapidly; and the membrana tympani exhibits, on inspec similar appearance. I have so frequently found this s the tympanum, in children, associated with convulsions or symptoms of cerebral irritation, that I believe it stands to in the relation of a cause. And if the pressure of a tooth the gum may so act upon the delicate nervous system of a as to cause convulsive seizures, surely it is not improbabl the pressure of a mass of thick mucus, unable to escape the tympanum, and probably being constantly increas quantity even through its own irritation, might have the effect. The intimate relation of the middle ear to the and the close sympathy that exists between them, is prov many well-known facts. Even a stream of cold water, ap hout force to the membrana tympani, may cause fainting in trong man.*

Cases illustrative of the co-existence of convulsive disease in ildren with the above-described condition of the tympanum, e related in the 39th volume of the *Medico-Chirurgical Trans- tions*, and in the *Transactions of the Pathological Society for* 57. Perhaps it would not be unreasonable that whenever a ild has a fit, or manifests any symptoms of nervous irritation ithout an obviously sufficient cause, the state of the tympanum ould be examined: in short, that the ear should receive the me attention that is universally given to the gums. This the more necessary because the symptoms of this morbid ondition are very apt to escape observation; those which I ave noticed to be most frequent are a habit of putting the ands to the ears, or rubbing them; a cry of real pain when he ears are roughly washed; pleasure taken in having the eatus gently irritated, as by the head of a pin. In these, as n all cases of cerebral irritation, the child cannot bear to be mped or otherwise violently moved. In one instance the ild had been noticed to throw himself upon the ground and ll about, apparently in play, yet so strangely as to attract rticular attention. The habit of rubbing the ears seems the ost constant symptom, and one to which (as in the parallel se of dental irritation) special attention should be paid. hese patients are sometimes noticed to be deaf; more fre- uently, especially among the poor, not so. Often they are ought to be stupid or inattentive. And here I cannot refrain om observing how frequently this is the case with children ho labour under incipient deafness, and how strong a claim hey have upon the surgeon to stand between them and their l-judging guardians, and save them from the grievous wrong nd injury that are too often inflicted upon them, under the dea that what is truly due to a physical infirmity results from moral fault. Too often blows are inflicted as punishment, which directly aggravate the disease. In the case of a youth who died with caries of the petrous bone and abscess in the cerebrum, and in whom the symptoms of aural disease dated from early life, his father had been in the habit of boxing his ears for 'inattention.'

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* Convulsions are enumerated among the causes of deaf-dumbness; but there is every reason to believe that in some of these cases the connection of events lies the other way, and disease in the tympanum has been the cause of the convulsions.

In the treatment of this class of cases, incision of the membrane should doubtless be insisted on, but I have had little opportunity of testing its effect. They are for the most part seen only by the ordinary medical attendant, and no advice is sought for the ears. Attention to the general health and to the condition of the fauces of course are necessary, and I have thought also that the application of the tincture of iodine to the neighbourhood of the ear, and the internal administration of the syrup of the iodide of iron, have acted favourably.

Inflammatory thickening and hypertrophy of the mucous membrane of the tympanum are met with, for the most part in connection with destruction, more or less complete, of the membrana tympani. Sometimes, though more rarely, they exist while the membrana tympani is perfect, being due in all probability to repeated attacks of subacute inflammation, especially in a strumous, gouty, or rheumatic constitution. The membrane is red, soft, and velvety, and may be so tumid as nearly to obliterate the cavity. The membrana tympani is more or less fallen in, opaque, thickened, and with a slightly reddish hue; congested vessels may be visible on its surface. The Eustachian tube is obstructed, or air enters with a creaking sound, as if forcing its way through an almost obliterated passage. The diagnosis, however, is difficult; the prognosis not favourable. Besides the ordinary local and general measures, small doses of the bichloride or biniodide of mercury may be given, in bark or combined with the iodide of iron, and of potassium, for a considerable period; or any medicines adapted to combat the rheumatic habit, if it be evidently present. Too much stress however, cannot be laid upon the regulation of the mode of life. A careful diet, exercise, avoidance of close atmospheres or sudden variations of temperature, may at least delay the progress of the disease.

Syphilitic inflammation of the tympanum.—It cannot be doubted that deafness is sometimes due to syphilitic affections of the middle ear; but these cases are rather to be distinguished by the history than by the condition of the organ.

Deposits within the tympanum.—Cholesterine is sometim found in this cavity and the mastoid cells in considerable masses;

n advanced life. Another form of deposit, which occurs
most part in the young, is probably of a tuberculous
er; it is a soft caseous mass, consisting of degenerated
d granular matter. In these latter cases there is most
tly a secondary or coincident affection of the brain.
ll[*] questions whether these deposits are of a strumous
er, and holds that they consist simply of inspissated and
rated pus. The coincident affection of the petrous bone
presents the characters of strumous infiltration, but
those of ordinary caries. Yet cases occur in which the
lar character of the affection can hardly be doubted;
mple, where tubercle exists also in the lungs, or where,
case reported in vol. xxxix. of the *Medico-Chirurgical*
ctions, tubercular masses, of a similar character, exist in
npanum and the adjacent portions of the brain. In the
strumous deposit within the tympanum, the membrana
ni generally ulcerates, and exposes the cavity. The
ent naturally suggests itself; but it is of course doubtful
er any treatment could be of avail. In the later stages of
is ulceration of the membrana tympani is a frequent
om.

branous bands, extending between different parts of the
num, and connecting the ossicula to each other or to the
f the cavity, are frequently met with after death. Re-
ng these I have made two observations, which appear to
be of interest. The first is, that mere mucus in the
num, if exposed to the air in a dissected petrous bone,
the course of a few days dry up into broad bands, undis-
shable by the eye from those which are so frequently met
It is true the 'bands' thus formed present no structure
the microscope, while some of the membranous adhesions
are found already existing on dissection have a fibrillated
rance. Yet it seems probable to me that mucus may
p within the tympanum during life, and may thus give
the appearance of bands in some cases. I am induced
d this opinion from the extreme frequency with which
membranous bands are found. Bands were present in
ut of 1,149 dissections of diseased ears made by Mr.
ee, and in 30 out of 94 such dissections made by myself.

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[*] *Guy's Hospital Reports*, vol. xxxvii.

They occur also in cases in which there is no other appear of inflammation, and indeed where the probability is very str that it has never existed. I have found a very broad and dist band in the mastoid cells of an infant four months old. I hard to understand how real fibrinous adhesions should f in such a cavity as the tympanum without the effusion o considerable quantity of lymph, which must involve, one wo suppose, an attack of inflammation of a formidable kind. have observed, also, that membranous bands in the tymp do not seem to affect the hearing to an inconvenient deg unless they also interfere with the motions of the ossicula.

An irregular concavity of the membrana tympani, the E chian tube being pervious, may give ground for suspecting presence of such bands, which will be rendered more prob if there be a history of previous inflammation. But a li instrument introduced by Dr. Siegle, and termed by him 'pneumatic speculum,' renders their detection, when they e to any serious degree, more easy. This instrument cons of a small box, having a slightly magnifying lens for one e and at the other terminating in a speculum which is made fit the meatus air-tight by means of a piece of elastic tub placed over it. From the box there passes off also a tube endi in a mouth-piece. If, now, having adapted the instrument the meatus, the surgeon applies suction by the tube, and at th same time keeps his eye fixed upon the membrane through th lens, it will be seen to move outwards, and may be made modifying the air-pressure to move to and fro. If it is bou down by adhesions these will reveal their presence by th interference with its movements. They are by no means insuperable cause of deafness. Not seldom they may ruptured by a powerful inflation of the tympanum on Politze plan. The patient feels a sudden snap in the ear, and at on hears better (for the most part), and on examining the membra a distinct effusion of blood on its inner surface may be see which is absorbed in a few days. The inflation needs to carefully continued. In other cases, if the nervous power preserved, injection of the tympanum with solvent fluids, described under 'Rigidity of the mucous membrane,' is oft useful. The same means, combined with the use of the cathe and bougies to the Eustachian tube until it is freely pervio are efficacious also in some of these cases in which there ex more or less complete disorganisation of the tympanum f

ffects of former inflammation, and the membrana tympani,
gh not perforated, is fallen in and lies in contact, or nearly
ith the promontory, while the soft structures are infiltrated
hardened secretion, and converted into dense and rigid
es. The power of hearing, in some of these patients, is
ter than the condition of the visible portion of the ear
d lead us to anticipate; and even the worst cases need not
ys be entirely abandoned. It is often the case that when
ear is much less sensitive than the other, the patient
ires the habit of entirely disusing it, and of relying solely
the better organ. Thus the function of the injured ear
mes deadened from mere lack of exercise, and it is capable
ing roused by use to greatly increased sensibility. Some-
s persons who have thus suffered one ear to fall into disuse,
nfortunate enough to meet with an accident, or suffer a
se, which destroys the other, and then they may obtain
t relief by bringing into use the latent powers of the
ected organ. By means of a hearing-trumpet, or sometimes
out it, an ear long supposed useless may be brought,
ugh persevering exercise, to play a very serviceable part.
he same ground, it should be a rule with the surgeon to
urage those who have sustained irreparable injury to one
short of total deafness, to maintain it in exercise by using it
e for a certain period every day. Those, also, by whom
ing can be performed only with difficulty through disease
oth ears, should be instructed to exercise what power
remain, instead of relying on the sight alone; and their
ds should be willing to aid them in this endeavour.

igidity of the mucous membrane of the tympanum.—I retain
expression, though I feel that at present its signification
t be held quite doubtful. It is not unlikely that the rigi-
of the membrane may arise, in the large majority of cases,
the gradual drying of retained secretion. But the data
not yet available for determining this point, nor is it, at
in confirmed cases, of practical importance. Whether
mucous membrane be, according to Mr. Toynbee's view,
id' from slow inflammatory or degenerative action, or be
ered so by condensed secretion, the effect doubtless in im-
ing the motions of the ossicula is the same; and so also is
reatment. If there be vigour in the patient's constitution,
the nervous power seems to be moderately well maintained
.g. if the tuning-fork be better heard in the *worse* ear),

benefit is generally derived from the continued injecti
solvent or astringent liquids into the tympanum.

There is one qualification to this remark, however, viz.
when a true bony anchylosis of the stapes exists, benefit c
be expected, and I do not know any symptoms by which
certainly be distinguished during life. I believe, however
the result of my dissections, that this is a decidedly rare
tion except in the aged, and, I think, that symptoms of
failure generally accompany it. In cases of ‘rigidit
meatus is frequently found devoid of cerumen; the me
tympani is either natural or slightly opaque; occasio
may contain calcareous deposits. The Eustachian
pervious; and the air enters often with a loud or a w
sound. No pain is present; but there is generally an a
tinnitus. The ‘adapting power’ of the organ is more
than the mere ability to distinguish sounds. The pa
embarrassed in general conversation, while able to he
voices with tolerable ease. This symptom, however, r
exist in cases of nervous deafness, arising from the ex
connected with a large company; but the mode of its
tion is different, and in the latter cases excitement
the same effect under all circumstances. Hearing be
noise, as while riding in a carriage, or during the beat
drum, appears to be common to this with some other
conditions.

It has been recommended to treat this affection with
irritants, nitrate of silver applied to the membrana
baths, and inflation of the tympanum with medicated
But, I believe, the only plan which is at all reliable, is
at short intervals into the tympanum medicated s
Those which I chiefly use are carbonate of soda (gr. x.—
hydrochlorate of ammonia gr. x. ad ʒj., with which I
combine perchloride of mercury (gr. $\frac{1}{8}$); and sulphate
gr. ij.—vj. ad ℥j.;—the first as a mere solvent, the s
stimulating and absorbent, and the last as an astringen
various others, as liq. potassæ, tinct. iodine, and arg.
small quantities, are recommended, and probably have
advantages in some cases.

There are two ways in which they may be applied, the
to introduce a few drops by means of the Eustachian c
through which it is easily blown into the tympanum
elastic bag. This may be done from once to three t

ek, and continued for three or four weeks. If it is beneficial an be resumed at intervals. At the same time friction with ine and ammonia, or occasional blisters, can be employed; d the throat should be kept clear by solution of soda drawn syringed through the nostrils. Many cases that would herwise have been hopeless, may by this means be very eatly improved. It requires of course the continued attend-ce of the patient, and when this is impossible, or seems not stified by the probability of benefit, this may be dispensed ith (although not without some disadvantage), and he may imself force a solution of soda or ammon. hydrochl. into his wn tympanum once or twice a week. The method of doing his is very simple, and was first pointed out by Dr. Gruber, f Vienna. The patient inclining his head well to the affected de, introduces into the nostril of the same side a glass syringe ontaining about ʒij. of the solution. This he syringes firmly nto the pharynx, where it lies in contact with the orifice of he tube. He then quietly and without swallowing inflates the ympanum. With a little practice he thus quite easily forces a ittle of the liquid into the tympanum. If the tube be not ervious, of course it must first be made so, and before this plan is adopted, it is well to clear the posterior nares and pharynx well by a solution of soda, through the nose, twice daily for a week. There is more risk of irritation on this plan, but I have known it also answer very satisfactorily, and in cases of long standing.

Warm vapours containing iodine, &c. introduced through the Eustachian catheter, by means of an air press, or an elastic bag, though less useful, appear sometimes efficacious, and often form a valuable adjunct. But *the* remedy is liquids.

Dr. Weber, of Berlin, has suggested the introduction of a very small elastic tube through the ordinary catheter, quite into the tympanum—a proceeding perfectly feasible—and by means of it the direction of a stream of medicated spray to any desired region of the tympanum. By this means much stronger solutions may be employed with safety, but perhaps the difficulty of deciding when and at what point they are required, will for some time remain.

In some obstinate cases I have seemed to find benefit from the biniodide of mercury (gr. $\frac{1}{32}$), combined with syr. ferri iodidi ʒj., and potass. iod. gr. ij. ter die, continued for some weeks. As a rule I use the solutions only to one ear at a time, and having thus a point of comparison, I have been able to convince myself of their benefit in some cases in which, at the patient's own request, they have been employed at intervals for upwards of two years. But, I think, no skill in diagnosis can, with our present knowledge, avoid failures; especially perhaps in young women, who, as a class, are very liable to this or some like form of deafness. General tonic regimen and especial avoidance of close rooms and other causes of catarrh, and also of the too free use of cold water to the head, are of course to be insisted on.

This form of disease, together with that next to be mentioned, has been ascribed to a gouty or rheumatic constitution. On this point, however, farther investigation may be needed. Dr. Garrod informs me that he does not find gouty or rheumatic patients especially liable to deafness, the ear forming in this respect a decided contrast to the eye; and Dr. Gull has submitted to examination some deposits from the tympanum supposed to contain acicular crystals of uric acid, and has found them to consist of fat.* The best-marked case of the connection of deafness with the gouty diathesis that has come under my own observation is that of a lady, aged fifty-seven, subject to attacks of gout, and slightly deaf. On the occasion of the sudden death of her husband, an intense deafness came on in the course of a few hours, which subsided on the local manifestation of gout two or three days afterwards.

Anchylosis of the stapes to the fenestra ovalis.—This is an affection our chief knowledge of which we owe to Mr. Toynbee. It consists in a union, by bone, between the base of the stapes and the margin of the fenestra ovalis. This condition may exist in various forms, either that of a simple expansion of the base of the stapes, or an expansion combined with a calcareous whiteness of the bone, or with effusion of osseous matter within or around the joint. In some cases, there is found a thickening and rigidity merely of the ligaments connecting the articulating surfaces. The general symptoms are very like those of the last-mentioned affection. How far treatment is of any effect there is as yet no sufficient evidence to show.

In Canstatt's *Jahresbericht* for 1859 is an account of a paper by Voltolini on this subject. Taking into consideration the very slight amount of motion normally possessed by the stapedio-vestibular articulation, it appeared to him

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* *Guy's Hospital Reports*, 1857, p. 289.

hat the deafness which occurs in its anchylosed condition could arise
mmobility. Experimenting upon the subject, he found that vibrations
smitted best from air to a limited surface of water, when the latter
red by a plate, which was not solidly connected to the boundaries of
ure. It is to the alteration in this respect, therefore, and not to loss of
n which might be given to it by the muscles of the tympanum, that
es the deafness which accompanies osseous anchylosis of the stapes. In
the diagnosis, he rejects the relatively greater inability to understand
nversation than to distinguish single sounds, and relies chiefly on the
ce of the external portions of the ear:—the meatus dry, widened,
vital reaction, and leathery; the membrana tympani parchment-like,
k, opaque, sometimes with earthy deposits, and immobile. The affection
oo, in dry and harsh constitutions. The sound, on inflation of the
ian tube, is normal, or too full, and the act produces no improvement.
ts all treatment.

nection with this affection, Mr. Toynbee has reported a case in which
emporary improvement was effected by a loud shout uttered close to
this improvement being ascribed by him to a loosening of the stapes
ts articulation. Perhaps the following case, related by Triquet, was one
ilar nature. A man had suffered from deafness, coming on gradually
years, without any known cause. It was attended with tinnitus. In
despondency he fired a pistol into the right ear. The bullet destroyed
icle and fractured the meatus, passing out beneath the scalp. The
in that ear was raised by the shock from two to twelve centimetres. I
so seen a gentleman in whom deafness of several months' standing
y ceased on an engine passing close to him with a loud whistle. The
is case (some years subsequently) showed nothing abnormal.

ed, the causes which will sometimes seem to improve
aring in cases of deafness are such as we could by no
anticipate. An elderly lady, who had been under my
r deafness, attended with perforation of the membrana
ni, was seized with paraplegia. The hearing became
dly better at the time of the attack, and continued so for
ears.

stoses, or deposits of osseous matter, are occasionally found
other ossicles.

ase also is on record of *fracture* of the handle of the malleus. It was
the body of a man who died in Guy's Hospital from disease quite un-
d with the ear, and is reported in the *Pathological Transactions*, vol. x.
The fracture took place just above the processus brevis, at the point
he tensor tympani ligament is attached; the fractured surface was
and convex, and seemed to have played on a false joint upon the body
alleus, which was displaced inwards. I have seen another also, produced
lden blow while picking the ear with a wire. The deafness was very

ocation of the ossicula is more frequent; it generally
between the incus and stapes, and is accompanied with

caries of the bones, or other effects of inflammation. In the severer forms of inflammation of the mucous membrane of the tympanum, indeed, caries of these bones is not an unfrequent result. For the most part, when this occurs, the membrana tympani is perforated; but this is not always the case. The head of the malleus, the incus, and one crus of the stapes, have been found to be destroyed by caries, the membrane being entire.* The patient was a woman aged thirty, who died of acute peritonitis. The artificial membrane is suitable for these cases.

In cases of perforation the incus frequently comes away in a more or less carious state; the malleus also, but less frequently; and still more rarely, the stapes may be separated from its attachments and cast off. Whether total deafness necessarily results from loss of the stapes, involving as it must do the discharge of the perilymph from the internal ear, is as yet undecided.

Diseases of the Mastoid Cells.

Besides participating, as they for the most part do, in inflammatory diseases of the tympanum, the mastoid cells are subject to affections which do not involve that cavity. They may be the seat, for example, of deposits, chiefly of cholesterine, while the tympanum is free; and inflammation leading to caries or necrosis of their osseous walls may co-exist, though seldom, with a comparatively healthy state of the adjacent parts. The latter affection is more frequent in childhood than in adult life, and, whether consequent upon disease commencing in the tympanum or not, demands prompt measures to prevent extension of the mischief to the intra-cranial organs. The symptoms are tenderness over the mastoid process, followed by redness and tumefaction; a discharge generally issues from the meatus, although the walls of this passage may be perfect. Sometimes an obscure fluctuation may be felt behind the ear. There is generally at this stage of the disease headache, and pain extending over the back of the head and neck; often giddiness, and other symptoms of irritation of the brain. The most essential point in the treatment is not to neglect, nor to defer too long, an incision, freely exposing the bone. This should be made in the vertical direction about half an inch behind the ear extend the whole length of the mastoid process. Great almost invariably follows. Sometimes pus will escape, e knife will penetrate the softened bone. Poultices should lied, and a free discharge encouraged. Portions of dead nay come away, or the wound may gradually heal without tion. If the cerebral irritation should continue, a seton l to the nape of the neck, or an issue in the arm, may be useful, the utmost care being at the same time taken to a free exit for matter. There are now nearly twenty on record in which the mastoid process has been tre-

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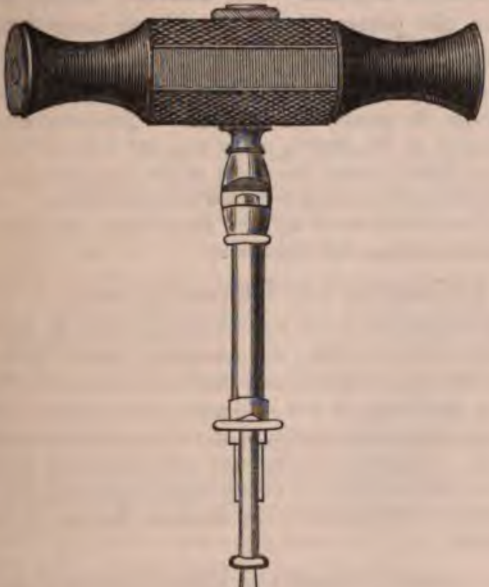
* Triquet, from the *Gaz. des Hôp.* Jan. 1851.

FIG. 150.



Instrument for perforation of the Mastoid Cells.

d, or otherwise perforated, for the evacuation of matter ned within it. Of these it may be said that almost every ppears to have been successful that was not performed too The operation is a simple one, and by aid of the instru- (Fig. 150) may be carried out with great safety. It should be neglected when, after the periosteum covering the id process has been freely divided, symptoms of cerebral ion still continue.

VI. AFFECTIONS OF THE LABYRINTH AND AUDITORY NE

These are divisible into two classes; those in which dem strable pathological changes are or are not present. But knowledge on the subject, and our means of diagnosis, are b as yet very imperfect. Among the morbid conditions fo within the labyrinth, the most frequent are: vascularity of walls and membranous tubes; deficiency of the labyrint fluid; excess of otoconia; effusions of lymph, of red serum of blood, the latter being chiefly found after typhus or typ fever. The tympanic aperture of the cochlea has been fo filled with osseous deposit. The auditory nerve is someti especially in old persons who have been long deaf, atrop and much reduced in size.

In some instances, the bony portion of the internal ear becomes necrosed finds exit through the meatus externus without producing disease withi skull. In a patient of Mr. Shaw's, a boy who had suffered from scarlatin years and a half before, almost the whole of the bony labyrinth was thu off, being removed by the forceps from the external meatus.* And in th of an old man, who came under my own observation, the entire cochlea some of the adjacent bone, had come away.

Menière has reported two interesting cases:—

One of a girl exposed to severe cold for several hours, by having to tr an open carriage at night, during the catamenial period. In a few hou became completely deaf, without pain. Death soon followed. There was throughout the labyrinth, 'a sort of plastic, reddish lymph, which ap to be the product of an inflammation of all the membranous surfaces whi the internal ear.' In another similar case, proving fatal in two months existed the same plastic lymph, of yellow colour, occupying the labyrint a number of small grey, opaque points scattered through it, resembling mencing tubercle.

Few cases precisely similar to these have been met with but there is a frequent and well-marked affection which evidently to have some relation to them. The patient, pro entirely free from any previous affection of the ear, is sud seized with giddiness, and in severe cases with nausea, and himself unable to walk steadily; at the same moment he be conscious of a sound in one or both ears, which may be of v kinds; often it gives him the conviction of some external of sound. The giddiness, &c., pass off in a few days en but the hearing of one or both ears remains very great ed, and the tinnitus continues. Of the condition of the ble parts of the ear at the time of the attack I cannot speak, on examination, after the lapse of weeks or years, the tym-um appears quite normal; the nerve is partially paralysed. pathology of the affection is not yet known, since it appears to shorten life. My own guess is that the severer cases ate apoplexy of the labyrinth; the slighter ones, probably, sudden increase of fluid pressure. I have not found any dies successful. It is natural to suppose such an attack to nd on general impairment of health, and in most cases the nt is weak or anæmic. But I have met with the symptoms strong young man in whom I could discover no other ation from perfect health. With time the affection may be ected to become less severe.

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* *Transactions of the Pathological Society*, vol. vii. p. 335.

Akin to this affection are certain acute affections of children, which, after suffering from severe head symptoms, often with peated convulsions, the child recovers, but remains totally, or ost totally, deaf. Some of these cases are probably, at the mmencement, simply inflammation of the tympanum; but hers, no doubt, involve the nervous centres. They will be derstood when the ear is no longer thought too insignificant too remote to receive the attention of the physician.

A form of ‘nervous deafness’ also follows parturition, the mpanum remaining healthy; but more often the deafness at dates from a confinement includes a chronic tympanic flammation. Deafness sometimes co-exists with epilepsy, but e connection between the two affections is not clear. In one se, that of an otherwise healthy man, who had been the subject f syphilis, the hearing suddenly returned after a slight epileptic it—apparently the only one—and has not been lost again.

Painful affections of the fifth nerve, besides their influence in nducing and maintaining disease within the tympanum, may pparently induce paralysis of the auditory nerve. The hearing may be suddenly lost after a severe neuralgia. Connected with this, probably, is a fact I have noticed, that in ‘nervous deafness’ the tympanum is not unfrequently partially anæsthetic.

Falls on the head paralyse the hearing, as also do loud and long-continued noises, such as those to which boiler-makers are exposed. I have met with a man who almost totally lost his hearing through being in a church belfry while the peal was rung. Rifle-shooting deafens in some the right, in others the left, ear. A cannon that is suddenly fired on the Rhine steamers, to show an echo, has been assigned to me as the cause of deafness by more than one patient; as also has the sudden pressure involved in descending in a diving-bell. Quinine often produces temporary deafness, but I have seen no reason to believe this effect is permanent. An ounce taken by mistake at once produced deafness only for a time. The hearing is sometimes totally destroyed by scarlatina, evidently by some nerve affection. Mumps are peculiarly prone to induce an affection of this kind, the nature of which is yet unexplained. A sudden exposure to severe cold appears to influence the auditory nerve sometimes, as it does the facial. Tumours of the brain may have loss of hearing among their symptoms. But apart from any causes of a decisive character, a mere failure of the function of the nerve is frequently, though less frequently than has been supposed, met with among the deaf. It is easily recognised by the tests mentioned above; frequently an hereditary predisposition is present; the aspect is often peculiar, especially a certain look in the eyes; and for the most part there is aggravation of the deafness by excitement or depression of mind. Tinnitus, often constant, and of a very distressing character, is generally present.

Thus patients suffering from deafness due to conditions of the nervous system come under two classes: those in whom the affection is seated (probably) in the labyrinth, or auditory nerve; and those in whom the deafness is accompanied by general nervous debility, and is to be referred rather to the nervous centres. Among the latter are the cases of deafness arising from prolonged lactation, or the operation of other debilitating causes, such as fatigue in tropical climates, excessive exertion of body or mind, over study, sorrow, want of sufficient sleep. In persons predisposed to the affection, very slight causes may apparently determine its access. In one well-marked and severe case, it supervened upon the administration of a strong purgative. This form of deafness is by no means confined to adult life; if anything, it is more frequent in the young; and it may be met with among children at school, or subject otherwise to excess of study. Deafness has alternated with other affections as a result of worms.

I am of opinion that there may be a 'hysterical' deafness; at least, I have met with the case of a girl who suffered greatly from the confirmed inte ance of her mother, and who was liable to very complete temporary l hearing. It would come on rapidly, and disappear suddenly, the hearing good in the intervals. The inspection of the ear revealed no disease.

The extreme slightness of the causes to which nervous deaf- s often appears to be due, early attracted my attention. ave known it brought on by a quarrel, and even assigned by rong man to the excitement of requesting from her parents r daughter's hand. In this last case, however, it appeared t, a few years before, the patient had been stunned and tially deafened for a time by a fall down his college stairs. s probable, surely, that the real cause of his deafness was fall, and not the quite normal mental agitation with which access coincided. And further observation has confirmed in the opinion that the 'nervous' form of deafness, which ows trivial causes, is very often due to shocks or diseases g previous, of which the effects have remained, and were ent or unnoticed, until the occurrence of some slight ac- ent. And among these 'latent' causes of nervous deafness m disposed to assign a very important place to the 'ear- he' which is so common in childhood, especially if it be *not* ended with discharge.

There is one symptom which is present in some cases of rve deafness which appears to me of considerable interest, . an *inversion* of the normal effect on closing the meatus, ile the tuning fork is placed upon the vertex. Very many tients, assuming instead of observing, will say at once that sound is diminished, but need only to have their attention oused to recognise that it is increased. But there are some o so persistently and intelligently affirm that it is dimin- ied, and they form so consistent a group of cases, that it is possible to question the fact. This diminution of the sound the tuning-fork on closure of the meatus, appears to me at esent to be explicable only as an indication of an increase of e fluid pressure within the labyrinth. I have not been suc- ssful in dealing with it.

The treatment of nervous deafness should be guided by the ture of the affection. If there be reason to suspect a syphi- tic taint, or if the gouty or rheumatic diathesis be well arked, and there exist signs, however obscure, of an inflam- atory or irritable condition of the labyrinth or nerve—as for xample, the increase of deafness or of tinnitus by moderate timulants, such as a single glass of wine—a corresponding ntiphlogistic and specific treatment might be had recourse to. ut for the most part, if the deafness be truly seated on the nner side of the tympanum, severe measures do unmitigated harm. Repeated blistering may effect a temporary improvement, at the expense of a permanent aggravation. Some reliable authorities recommend the continuous galvanic current, but my own experience and observation have not been very favourable. I should confine its use to one ear. Whenever the affection can be traced to any debilitating cause, and it is of recent access, the removal of the cause with a general tonic hygiene may be attended with a perfect cure. Mr. Toynbee had great confidence in a combination of quinine and morphia in small doses, taken perseveringly once or twice a day. Stimulating liniments around the ears, perhaps containing chloroform, if tinnitus is a prominent symptom, are at least unobjectionable; and the use of cold water and friction may in most cases be advised. I have seldom known benefit produced by strychnia. Mr. Braid, in the *Association Medical Journal* for September 1855, has reported cases of 'nervous deafness' benefited by hypnotism. In some cases connected with fevers, the biniodide of mercury with iodide of iron have seemed to do much good.

There is a form of nerve-deafness clearly connected with over work; I should describe it as a kind of reflex irritation from the nerve of special sense, to the nutritive and muscular nerves of the tympanum. It is attended with more or less tinnitus, and symptoms of irregular action of the muscles of the ossicula, and there are slight appearances of congestion of the mucous membrane. But in the main the symptoms are those of impaired nerve power, and they vary decidedly with the general tone. The treatment should be very careful so far as local measures are concerned, and the prognosis, if taken in time, and rest secured, is decidedly favourable. Children born in the tropics are liable to become deaf about the age of puberty, and to baffle treatment, for some cause unknown. A form of hardness of hearing that closely simulates failure of the auditory nerve, appears to me to be dependent upon loss of power of the tympanic muscles—in short, a failure of the tympanic adjusting power. The inconvenience is not very serious, though it is annoying. The patient complains that he cannot follow general conversation, and on examination it is found that the tympanum transmits sound fairly, and that the hearing for single sounds is good, but that quick modulations of voice cannot be followed. Galvanism might be useful in t cases.

hearing-trumpets are had recourse to in these cases—and are advisable when the deafness is confirmed—care should ken that they are such as not to try the ear, by producing ud metallic resonance. The patient's own sensations are best guide in selecting them, and they should not be more rful than is absolutely necessary. A very convenient form e that passes by a spring over the head; and in the case omen it may be almost entirely concealed by the hair. Mr. hall's may be specially recommended.

Loss or diminution of the nervous power often co-exists with r diseased conditions of the organ, and may aggravate the ct of inflammatory lesions of the tympanum, membrana pani, or meatus. In these cases the symptoms are of a ed character.

A true *neuralgia* of the ear exists, though rarely, except as nected with disease of the teeth. It is strictly periodic; e ear is healthy in all respects, and the hearing is not minished. It demands nothing peculiar in its treatment.

Tinnitus may exist as a symptom of the most various affecions, from cerumen in the meatus to undigested food in the tomach; and its treatment is, in the main, the treatment of s cause. But when it seems to exist as an isolated symptom, nd no cause can be clearly discovered for it, the remedy I ave found best worth trying is scruple doses of hydrochlorate f ammonia three times a day. It seems sometimes to have he same power over tinnitus that it has over some forms of euralgia. The bromide of potassium I have not found equally seful. Spirit of camphor and liq. opii, forty drops of each in n ounce of glycerine, have also given relief. Vapour of chloroform, applied through the Eustachian tube, has been recommended; but in very severe cases, as also in extremely obstinate neuralgic pain of the tympanum, I have found the injection of a few drops of a solution of atropine (gr. $\frac{1}{8}$—ʒj.) the most effectual local application.

A loud report like a pistol, occurring frequently as sleep approaches, I believe to be due to over-fatigue; especially to over-fatigue of the better ear, in cases of one-sided deafness. Some persons are troubled with cracking in the ear, keeping regular time, but intermitting; it is due, at least sometimes, o an action of the tensor palati upon the Eustachian tube; n some other cases the tensor tympani is the muscle in fault, and the malleus may be seen to move with each recurrence of the sound. Some persons have the power of voluntarily producing one or other of these movements.

Excessive sensibility to sound (or hyperacousia), and the perception of a second sound, often discordant, accompanying every tone (paracousia), are rare phenomena, except as occurring in the early stages of inflammation within the tympanum. They are, however, sometimes persistent, and occasion great annoyance. A case is quoted from Sauvage, in which a musician was compelled to give up his occupation because he continually heard a second inharmonious note with every note he played.

A buzzing sound, like the twang of a loose harp-string, sometimes accompanies particular notes. This occurs, I believe, during the early stages of catarrh. Inability to hear certain notes has been observed, and is ascribed to loss of power of certain special portions of the cochlea. Dr. Lucae relates a case of this kind in which he constructed 'resonators' answering to the missing notes, and by wearing these the patient regained the lost power.

Among the causes of deafness, having its seat partly in the nervous structures of the ear, must be mentioned *hereditary syphilis*. According to Mr. Hutchinson's experience, which my own has entirely confirmed, deafness of a very extreme character is frequent among this class of persons.

The general characters of the disease as described by him are present. The deafness occurs for the most part about the time of puberty, and rapidly becomes very intense. The tuning-fork is scarcely heard upon the head. The membrana tympani is generally but slightly altered, and the Eustachian tube is pervious. Among the poor and hardly-worked, the prognosis is very unfavourable; but among those more fortunately circumstanced, a satisfactory result may often be obtained. The medicine that has seemed most useful to me is the hydrochlorate of ammonia in ℈j. doses, but the ordinary mild specific treatment may be serviceable. Injection of vapour of iodine, or of the mixed solution of ammon. chlor. and hydr. perchlor. into the tympanum, have appeared to do most good.

VII. Diseases of the Ear implicating the Brain or Lateral Sinus.

This fatal class of diseases has been long recognised, but ich additional light has been thrown upon their pathology the investigations of Mr. Toynbee and Dr. Gull. The former s shown that inflammation of any portion of the ear, either the meatus, the tympanum, the mastoid cells or labyrinth, ay extend to the bone, and lead to a fatal issue; and has tablished it also as a general rule that disease advancing om either of these portions of the organ sets up morbid tion in certain definite localities within the cranium. Thus flammation of the meatus or mastoid cells tends to produce sease of the lateral sinus or cerebellum, except in young ildren, in whom the mastoid cells are very small, and are in lation rather with the cerebrum. Inflammation of the mpanum for the most part extends towards the middle cere- ral lobe; and when the labyrinth is involved, which seldom appens except by extension from the tympanum, the progress f the disease takes the course of the auditory nerve towards he medulla oblongata. Other observers, while allowing the reat exactness and importance of the relations thus pointed ut, have held that exceptions occur, and that disease, com- nencing in any portion of the ear, may progress inwards by arious routes.

The chief secondary diseases produced by aural inflammation are three: inflammation of the dura mater and the other membranes; abscess in the substance of the brain; and inflammation of the lateral sinus, with its effects. The two former of these affections are for the most part found together; but cases not unfrequently occur in which, while the dura mater is inflamed, the cerebral tissues exhibit scarcely any appreciable alteration; or, on the other hand, in which one or more abscesses exist within the brain, while the dura mater appears healthy. Besides these cases of demonstrable secondary disease resulting from inflammation within the ear, instances occur in which death takes place with symptoms of cerebral affection, but in which no lesion whatever is found except within the tympanum.

The early symptoms of implication of the brain are rigors, often at first resembling attacks of ague (so that they have been treated with quinine); and pain in the head, gradual becoming intolerably severe. This pain for the most pa extends over the back of the neck, and it is greatly increase by motion. Delirium, impairment of consciousness, of speech or of muscular power may ensue, and death follows, the pai generally being intense until the last. The sudden cessatio of a chronic discharge from the meatus, accompanied by pai and fever, frequently marks the onset, or at least the threatening of an internal inflammation.

The symptoms, however, are not always of this acute character. As in other forms of abscess within the brain, there may exist for a considerable period scarcely any indications of the serious mischief that has taken place. Treatment, in this affection, is of avail to save life only in the earliest stage. When suppuration is established within the brain, and there exists a diseased bone in its immediate vicinity acting as a constant source of irritation, it is probably vain to hope to do more than alleviate the sufferings of the patient. The first and main indication in all cases is to obtain and preserve a perfectly free exit for matter. A case is reported by Dr. Gull, in which, though it issued fatally, a decided mitigation of the symptoms followed a discharge of matter through the nose; and an indication is thus afforded of the surgeon's chief task in every instance of this affection. Perforation of the membrana tympani, if it be entire; or its incision, if by adhesion to the promontory or otherwise it act the part of a valve; or trephining of the mastoid process, should be had recourse to, and promptly if necessary, to avert the retention of pus. In some cases polypi seem to obstruct the meatus; and then their removal becomes a matter of the utmost importance. A case is related by Bonafond, in which the crushing of a polypus gave exit to a large quantity of matter, with immediate relief to the gravest cerebral symptoms, and others have occurred in my own experience.

When inflammation extends from the ear to the lateral sinus, it proves fatal by secondary disease of the lungs, which become affected with lobular pneumonia and pleurisy; pneumo-thorax also, and sloughing of the lung, frequently occur. The symptoms are rigors, with sweats, fever, pain in the head and back of the neck, followed by stethoscopic indications of pleurisy; vomiting is often present. Tenderness and swelling may generally be found in the course of the jugular vein. On examination after death the portion of the mastoid cells, forming the floor of the lateral sinus, is carious to a greater or less extent, and that vessel contains a disorganised clot mixed with pus.

Although when these affections of the brain or lateral sinus are once established, the surgeon is powerless to stay their course, yet many cases occur in which symptoms of the most threatening character may be entirely removed by care. In hese patients either the membrana tympani has been perforated and the mucous membrane of the tympanum inflamed, for a long ime, a purulent discharge from the meatus being either constant r occurring at intervals; or, without rupture of the membrana ympani, there is a chronic inflammation of the meatus attended ith discharge. During a cold, or from general ill-health, or rom a blow, or even without ascertainable cause, the symptoms ecome aggravated, perhaps the discharge suddenly ceases; ain arises in the ear, extends over the side of the head, and s greatly increased by motion; giddiness may follow, with nability to stoop; fever is sometimes, but not always, present, and there may even be delirium; or slight attacks of the kind may recur at intervals and pass off. In these cases an entire abstinence from work, or any kind of excitement, must be enjoined; and, except in the mildest forms of the disease, the patient should be confined to bed. Leeches should be freely applied around and beneath the ear, and by fomentations and poultices the external discharge, if it have ceased, should be encouraged to return. The meatus may also be syringed, very gently so as to avoid giving pain, with water as warm as it can be borne. After the leeches counter-irritation should be employed; and a seton may be worn at the back of the neck until every symptom of cerebral irritation has disappeared. Purgative and alterative medicines may be administered, according to the judgment of the surgeon; but the latter demand caution. The injurious effect of mercury, when once suppurative action has commenced within the brain, is well known. If there be any puffiness or tenderness over the mastoid process, an incision down to the bone in that region should not be omitted; and any obstruction to the escape of matter should be thoroughly removed. Under these means symptoms of a very serious aspect will often entirely disappear; but great perseverance and prolonged caution are required. Frequently an incision of the membrane and washing out of the tympanum, as before described, will be found the needful remedy.

Another fatal consequence of disease of the ear is hæmo rhage. This occurs from ulceration of the coats of the adjace vessels. Sir W. Wilde relates two cases, following scarlatin in one of which the lateral sinus was found ulcerated. On case I have seen in a man of middle age, in whom severe pai in the ear was followed by repeated attacks of bleeding fro the meatus. The patient sank, apparently exhausted by loss o blood; and on examination there was found caries of th tympanic walls, causing ulceration of the coats of the caroti artery.

VIII. Malignant Disease of the Ear.

This is an affection occasionally met with, though it is n frequent. It commences in the deeply-seated parts of the org and a large part of the temporal bone and of the adjacent po tions of the skull may be destroyed before life succumbs. Th affection calls for no special remark, except that, as befor observed, it is at some stages liable to be mistaken for polypus. The only case in which real difficulty would be likely to arise in the diagnosis, might be that of a polypus causing irritation of the brain by preventing the escape of matter; and here the history, and the difference of the symptoms in the two cases, could hardly fail to give the necessary guidance.

JAMES HINTON.

ISEASES OF THE ABSORBENT SYSTEM.

HE vessels and the glands of the Absorbent System are closely associated in their diseases, and cannot be conve- ntly or advantageously studied apart from one another. In following essay, therefore, a separate notice of either part the system will be taken only when some special facts of thology or of treatment render it necessary.

Wounds of lymphatics.—Although some of these vessels nnot fail to be injured in every considerable wound, they are rely noticed. A little lymph doubtless issues from them, but it is mixed with the more copious and more important outflow of blood, or with the subsequent oozing of interstitial fluids from the divided tissues. The wounded lymphatic tubes may be sealed by the common coagulum of blood; it is probable, however, that the lymph also by its own consolidation contributes to this effect.

'Dr. Monro inflicted a wound on the receptaculum chyli of a pig, which was cured in a very short time; and in the mean while the effusion of the lymph was prevented by its coagulation.' The exceptions to this rule, and to the repair of wounded lymphatics by the ordinary processes of healing, are so few and rare, that the following instances of failure may be mentioned.

'A case of this sort I saw in a butcher, who, by letting his knife fall upon his shin, cut some of the large lymphatic vessels which pass over the tibia. From this wound there flowed a considerable quantity of clear lymph, which, being confined by the dressings, jellied; and then, at first sight, appeared like a whitish fungus, but being loose could be removed with a spatula. My patient was cured by tight pressure, and lint dipped in a solution of vitriol.'[*]

A. Monro, after removing a tumour from the arm, found the wound heal and contract 'very fast, till a yellowish-white substance rose up from a small peduncle, at the part where the under part of the cephalic vein had been cut through. From this substance such a quantity of lymph oozed out from imperceptible orifices that the dressings were every day wet. I cut and eroded this substance away several times; but it quickly grew again, and the drilling of lymph became worse and worse, so that in a very little time it dropped so fast that I could have gathered a spoonful of it in a very short time. What cured it at last was, eating the fungus stuff and a little of the wound about with powder of Roman vitriol, and dressing the eschar with alcohol, which kept it from separating two weeks, in which time the orifices of the small pipes were soldered."[*]

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[*] Hewson, Sydenham Society's edition, by Gulliver, p. 198.

Besides these openings of lymphatics by injuries, there sometimes occurs an escape of lymph from vessels opened by disease. Dr. H. Vandyke Carter, of the Bombay Medical College, met with three cases in which he had reason to think that chyle escaped by leakage or rupture from lacteal absorbent vessels. Alternately with this cutaneous leakage of chyle, a similar fluid passed in the urine, and Dr. Carter concluded that the disease known as 'chylous urine' is not a functional error of the renal or digestive organs, but an accidental admixture of chyle with urine by the rupture of a lacteal vessel, concurring with a breach of the mucous surface in some part of the urinary tract. The patients were Hindoos, in whom great but varying swelling took place in the scrotum and groin. In one of the cases a fluid resembling chyle sometimes issued, and after food copiously, from a spontaneously formed and very minute opening in the skin of the thigh.[†] In March 1869, Dr. Day communicated to the Clinical Society of London a case which closely resembled those related by Dr. Carter. The right lower extremity of a boy began to enlarge at two and a half years of age, and when he was seven, the whole limb was thickened, the penis and scrotum swollen with distended lymphatics, and chylous fluid escaped from minute vesicles and openings at the frænum and on the scrotum, as well as at the lower extremity itself. On a particular examination it appeared that the limb was not merely infiltered with chyle, but was also overgrown, the bones and muscles participating no less than the skin and cellular tissue in the overgrowth. The reporting committee expressed an opinion that this hypertrophy of the limb was intimately connected with the distended state of the lymphatics, and they referred to four other cases in which lymphorrhagia with dilated lymphatics was associated with hypertrophy of the affected part, as well as to researches of Virchow upon hypertrophy of the tongue, which show that in that disease the muscular overgrowth is also of lymphatic origin.[‡]

Inflammation of lymphatics — Adenitis, Angeioleucitis. — In most instances of inflammation in the absorbent system, the vessels and the glands are both involved; the glands are rarely, the lymphatic vessels almost never, attacked alone. Many cases of inflammation of glands (*adenitis*) are regarded as spontaneous, or as the result of the direct influence of cold, until a careful inquiry shows them to be dependent on a prior irritation of the afferent lymphatic vessels (*angeioleucitis*). It is by no means unlikely, therefore, that some inflammations, which are now considered to be instances of primary adenitis, may yet be found secondary to some hitherto undiscovered primary cause of me kind.

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[*] *Medical Essays*, Edinburgh, vol. v. art. 27.

[†] *Medico-Chirurgical Transactions*, vol. xlv. p. 189.

[‡] *Clin. Soc. Trans.* vol. ii. p. 104.

ammation of the lymphatics occurs in many parts of the Traces of it are sometimes discovered in the interior of unk, after death, by the various changes it has produced; rum or pus; by thickening, opacity, or accumulated concre- in or about the lymphatic vessels. But it is hardly ever lly seen except in connection with the skin or an ulcerated ce.

e disease, as it thus comes under the observation of ons, is usually an acute inflammation, originating in previously irritated or inflamed tissue, extending in long w lines in the course of the absorbent vessels, and ving the nearest gland. It is often attended with heat transient redness of the adjoining skin, with considerable and with rather severe symptomatic fever; and it may in an effusion of serum and lymph, in suppuration, and in -poisoning.

st inflammations of the absorbents start from an open d. Such a wound may be in almost any condition, and of orm. It may be punctured, cut, torn, blistered, torpid, ng, scabbed. The mere state of the wound does not deter- the occurrence of the inflammation. It may, indeed, fest itself after the absorption of a poison without a wound, hen red lines cover the penis from recently contracted rrhœa; even breathing the exhalations of corrupting animal er may occasion it, although the wound from which the ioleucitis afterwards spreads be at the time sedulously red; but there is in most cases ample evidence of direct tion of the wound. The morbid matter may be some local mmatory product, as when the inflammation follows the nged friction of excoriated skin, or the confinement of the tions of a sore by a hard scab. More commonly, however, irritating or poisonous material is known to have been ied to the wound from without; or some gaseous poison, gh not known, may be the real, as it is sometimes the tained cause of the inflammation. My colleague, Dr. nhow, describes inflammation of the absorbents of the arm cceeding a diphtheritic exudation beneath a vesicle of the .* He has seen the same occurrence in the neck, connected with diphtheria of the throat, and fatal. Once only, and in a very rapid case, I have known an acute inflammation of the lymphatics, with redness of the skin, to accompany and indicate the first infection of the glands with secondary cancer (see p. 346).

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* Greenhow, *On Diphtheria*, p. 196.

The course of the inflammation is commonly pointed out by a linear redness of the skin, which is often many times broader than the vessel beneath. The lines follow the direction of the absorbents, not of the veins; and in the arm they may cease at the wrist, or the elbow, or at any intermediate part at which the inflamed lymphatic vessels end in a gland, or lose relation with the skin; but they never pass the armpit. The tenderness along such inflamed tracks is excessive, and it commonly extends to the next absorbent gland, whether the redness reach so far or not. The rapidity with which such lines are sometimes formed is remarkable, and is only equalled by the instantaneous ophthalmia which occurs when a foreign body enters the eye.

> 'Mr. Hunter saw a case, in which the skin being pricked by a needle which had never been used before or touched any infectious or irritating substance, occasioned the lymphatics of the arm to inflame, and show themselves in the form of red lines, running towards the axilla; in consequence of this, some of the glands there also inflamed and swelled, the patient had rigors and sickness, and all this in the space of a few minutes.' *

Such extreme rapidity in the development of inflammation is unquestionably rare, although Cruikshank states that he has seen other similar cases in the instance of the absorbents. The red lines, indeed, are not invariably formed; and this may be readily understood, if they be regarded as occurring only when the inflammation is widely spread, and therefore rather intense.

The inflammatory action, as indicated chiefly by these red lines, sometimes extends slowly, and as it were continuously by the tissue of the lymphatic vessels; far more commonly it attacks them simultaneously in nearly their entire length, and appears to be consequent on their becoming filled with fluid of an irritating quality. That the latter is the mode of origin is further likely from the fact, that the disease travels only upwards from the wound to the next gland, and not in the opposite direction. It will extend, for instance, from a wound on the knuckle to the axilla, but not along the finger; from the heel to the ham, but not to the foot. There are some apparent

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* Cruikshank, *On the Absorbents*, p. 76.

ll. There was no suppuration in the axilla. They were all
d got well; yet inflammation and œdema, if not suppuration,
ok place at the finger. It was clear that the highest abscess,
est, was the first formed; and that each of the others successively
er the one above it. The only cause which appears assignable for
esses is, that fresh matter arriving from the finger accumulated
eceding ones, until at last, by the inflammatory action in the
urce of the irritation was got rid of. Wiseman describes a similar
which apparently descended along the absorbents of the thigh
man came under my care for suppuration spreading from the
ching down the side of the trunk to the loin. Vast quantities of
evacuated by dependent openings, and the suppuration was
appropriate bandaging, injections, medicines, and food. As the
ided, the hand began to suppurate in a spot from which inflam-
ding by the absorbents, appeared to have first occasioned the
axilla. The man recovered.

mmation ceases at the nearest gland. This is a fact
exemplified both in the simple and the specific
on of absorbents. The known situations of the super-
s are those towards which inflamed absorbents may
and at which their inflammation culminates to its
ree of severity, and is almost invariably extinguished.
appears to arrest the free progress of the acrid
elf becoming inflamed. Sometimes the current
lymph through it is completely stopped; at other
es passage to the lymph, or itself supplies morbid
the higher absorbents and the circulating blood.

issues in extensive suppuration. The gland in the former ca may be felt rolling in the tissues, almost as readily as in health, and its tender and swollen state outlasts the inflammation o the afferent lymphatic vessels by a few days. It may, however enlarge to twice or thrice its natural size, and continue swoll and tender for two or more weeks. This is especially noticeab in the case of a gland near the femoral ring; the tenderne tension, even surface, and position of which sometimes cause it, when recently inflamed, to be mistaken for a strangulated herni especially if at first there should concur with its inflamma some nausea and constipation. Or, further, the gland ma suppurate. This event may not ensue until a week or mo after the inflammation of the lymphatic vessels has pas away. It is sometimes indicated by a renewal or increase the local pain, and by rigors and other constitutional sympt But not at all unfrequently suppuration occurs in a gland wi out any local symptoms which attract notice. The first pa attending the inflammation having subsided, a patient may b unconscious of any disease in his armpit, while matter to t extent of half a pint or more may be collecting there an behind the pectoral muscle. Suppuration is rarely limited the area of the gland. The suppurating structure is rather t loose areolar and adipose tissue in which the gland is embeddi and which here, as elsewhere, is observed to suppurate with less degree of inflammation than that which already exi without exciting suppuration, in the inflamed organ. Abscess connected with inflamed glands may therefore reach any which their position allows; they are, for instance, prone to larger in the loose tissue and spacious area of the axilla tha any other region occupied by superficial glands. The mat discharged from them is thick and well formed; and afte and any slough which may have been produced by the intens of the inflammation have been evacuated, the cavity clo Usually an abscess in the armpit or groin soon heals, b sometimes when it has burrowed far beneath the fascia, and the popliteal space, the cure is slow.

Inflammation and suppuration of the glands appear to eliminative as regards the afferent lymphatics and the inju distal parts, and protective as regards the circulating bl During the continuance of suppuration in the axilla, the acti of inflammation in the distal parts subsides, as gonorrhœa often temporarily suspended so long as a bubo is forming ly discharging.* On the other hand, the poison which reached a gland by way of the lymphatics does not pass ond it. When, however, a cutaneous pustular eruption es out on the trunk, or severe constitutional symptoms, like se of pyæmia, arise, it is clear that the morbid poison is not ited by the gland in the manner supposed. Of the various otheses by which these occurrences may be explained, those m most consistent with the anatomy and the other diseases of absorbent system, which assign the pustular eruption to the stomosis of minute cutaneous lymphatics, and the infection he blood to the glandular suppuration itself. In the former e, the poisonous matter which is held back by the suppuration verses the collateral channels, and produces pustules wher-r it filters over the vast area of skin subordinate to the tructed glands. In the second case, the matter from the nd itself is assumed to find a passage along the efferent ph-tubes into the blood.

The constitutional symptoms attending an attack of acute eioleucitis are sometimes severe. Rigors, nausea and vomit-g, heat of skin, thirst, dryness and coating of the tongue, th constipation, sleeplessness, and considerable nervous agita-on, a quick bounding pulse, and a feeling of languor, are ually the severest accompaniments of the disease. If the ver be typhoid, if there be profuse fœtid sweats, severe mus-ular pains, high excitement, a dry burning heat of skin, and arked delirium, the poison is no longer limited within the mphatic channels, but has infiltered the cellular tissues, and as tainted the blood.† As the inflammation subsides, and cal suppuration, a cutaneous eruption, or fœtid discharges om the bowels, come on, the general symptoms become those f exhaustion.

The cases depicted in the foregoing description are those of onsiderable but of ordinary severity. There is much variety n this respect, however, in different cases. There may be a ere passing soreness, with some enlargement and hardening f a gland, whilst the intermediate lymphatics between the

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[*] 'Ubi pestis minus sævo morsu lacessit, in molliores decumbit glandulas, ue ad corporis superficiem prominent; quales sunt inguinales, axillares, &c. convalescere datur ægrotanti, tumores ii, uti in variolis, legitimam nanciscuntur ppurationem, morboque naturam hac via exonerant.' (Mead, *de Curatione stis.*)

[†] See Erysipelas, Animal Poisons.

wound and the gland have either not inflamed or been so l
irritated that no pain or inconvenience had been felt in th
A hard cord may be felt beneath the skin, leading to a te
swollen gland, but there may have been no red lines, and
may be no suppuration. There is sometimes an axillary ab
without the previous occurrence of red lines, and the
may form without occasioning any axillary tenderness. S
times the track of the absorbents is tender for a day or
before the red lines appear, but more commonly th
amongst the earlier symptoms of the inflammation. I
case I have seen red lines appear twice between the wou
the armpit. No suppuration took place in the inflamed
but a pustular eruption over the trunk seemed to sh
some poison which had passed the gland was being elim
by the skin. In another case the absorbents inflamed
occasioning the linear redness on the skin, and three ab
formed in the axilla. There was in this case no cu
eruption. When suppuration occurs, it most commo
so only in the gland; but it may take place in the ab
track, without involving the gland, or may affect b
vessels and the glands. In the later progress of the
cases additional symptoms and pathological changes
sult from particular constitutional tendencies of the
Thus I have known inflammation of the absorbents of
terminate in fatal acute œdema of the tongue, the ab
being infiltrated from the thumb to the submaxillary gl

Simple traumatic inflammations of the absorbents pr
particular localities. They are very much more commo
arm and axilla than in any other parts of the body. A
observation has been made respecting plague, and the r
both cases appears evident. The hand, from which th
flammations originate, is at once more liable to inju
except the face, more exposed than the rest of the
Glandular suppurations in the mesenteric, lumbar, an
chial glands are as small as they are rare, and only som
cases of iliac and pelvic abscesses following upon par
are to be compared in extent with those in the armpit.
situation glandular suppuration calls for an especial not
at the lower part of the left side of the neck. A sev
deeply seated acute abscess is apt to form in that si
and, as it is bound down by the fasciæ and platysma
region, it may continue long without finding an out

asions great swelling, œdema, tension, and pain. The root the neck is much raised by the swelling, and the clavicle den. In all the cases which I have seen, the abscess was the left side of the neck, involving the whole region of the vical part of the thoracic duct, and not extending into the lla. The cause of these great and severe suppurations is metimes obscure, and they may not always originate in ease of the lymphatics; but sometimes such a mode of origin es appear, and in one of my cases an enlarged tender gland s described as having been first felt. It should also be membered from how many parts lymphatics converge towards e left side of the neck. This is the only situation in which I ve known an acute and severe suppuration subside without e external discharge of the pus.

Inflammation of the lymphatic glands, *adenitis*, sometimes curs alone, *i.e.* without any previous perceptible inflammation the afferent vessels. It does so after some of the fevers of ildhood. The higher cervical glands are then very liable to ell and become painful. Being in the neighbourhood of the wer jaw, tongue, and pharynx, all movements of these parts e restrained, and a good deal of suffering attends mastication d swallowing. Such cases of adenitis follow scarlatina, and e sufficiently explained by the state of the throat. These ases are not to be confounded with those of true cynanche arotidea. An absorbent gland in the centre of the parotid ay inflame as lymphatics inflame elsewhere, but its disease oes not produce the characteristic, contagious, and metastatic ffection commonly known by the name of mumps.

Treatment of inflamed absorbents.—Many of the ordinary duties f life expose persons to this painful affection; and it often rises in circumstances to which busy manual labourers pay no ttention. Soaking fresh cuts in Burnett's fluid, or the application of collodion upon a small wound or puncture, or of court-plaster upon a longer wound, might avert many of the attacks f inflamed absorbents.* When patients with wounds of any kind are under medical advice, the common precautions of cleansing the wound, securing the proper action of the purifying organs, and avoiding unhealthy diet, air, and occupations, are enough to prevent such attacks. Upon the occurrence threatening of an inflammation of the absorbent vessels, wound may be soaked in undiluted sulphurous acid, a mea which I have found to arrest suppuration near the finger- produced by an animal poison, and already beginning to in the lymphatics. The wound should in all cases be thorou cleansed. It should be opened, put under a stream of wa syringed, or soaked in a thoroughly hot bath, as may best its form and condition. If recent, or punctured, it shoul sucked, and then touched throughout with a stick or pen nitrate of silver. If flabby, it should be stimulated wi suitable mineral lotion. If fœtid, it should be wrapp solutions of Condy's or Burnett's fluid, or in chlorinated l If sloughy, it should be covered with Peruvian balsam poultice of linseed meal, charcoal, or beer-grounds. Heat all these cases grateful to the patient, and if often change order to secure the cleansing of the wound, a poultice generally be found the best local application.

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* The practice of smearing the hands with glycerine or oil before touching oxious fluids is found to prevent the mischiefs which might arise from absorpion, and is of great value at post-mortem examinations.

The lymphatics themselves are best treated by the nitr silver. It should be wiped a few times on the moistene along the red or tender lines. Care should be taken apply it too freely, as the subcutaneous inflammation can effectually moderated by blackening the skin as by blis it. After soaking and applying caustic, the surgeon may the limb in cotton wool, and enjoin complete rest.

The glands in the early stage may not have shared flammation, yet the nitrate of silver may be applied over also, and the use of it should in all cases be carried highe the tenderness and redness of the surface. The removal further irritation from the wound, and moderating the infl tion of the lymphatic vessels, will in most, but not all, secure the patient from suppuration in and near the glan further means appear requisite for this end, they may be in leeching, and the application of ice or a cooling lotion surface. I have not, however, found cold adapted to threatened suppuration in glands. Heat is commonly grateful to the patient than cold in such cases. It employed in a bath or in the form of steam. The latte be directed from the spout of a kettle against the tens painful part by means of a paper tube. If the inflamm continue, mercurial ointment is also useful; it should not only over the gland, but along the track of the pr nphatic inflammation, which has already indicated the tural channel for absorbed remedies to reach the inflamed and. It may be observed, however, that in not a few in-ances, when once the glands have inflamed, no treatment erts suppuration, and special attention must always be rected to them for a week or two after the first inflammaon, in consequence of the occasionally insidious progress of scess after adenitis. When acute glandular abscess is adancing to the surface, and occasioning much pain, it should opened. But if there be any reason against this treatment, uch relief to the suffering, and some acceleration of the ointing, are obtained by leeches. From one to three leeches e quite enough for this purpose; a larger number would have e effect of retarding and diffusing the suppuration. In like anner the slow progress of a chronic abscess of glands may ometimes be quickened by the application of a small blister pon the prominent part of the swelling.

The treatment in the lymphatic inflammations of convales-ents is chiefly that which will relieve the pain and guard gainst the somewhat rare event of suppuration. Steam, fol-owed by an application of cotton wool, ordinarily serves this urpose, and pure air, without draught, is also of much im-ortance.

Hypertrophy and atrophy of glands.—One of the first facts bserved in studying the lymphatic system is, that in disease, nd still more in health, its condition varies with that of the issues from which its vessels spring. So far as age defines the ctivity of growth and nutrition, the glands vary with it. They are proportionally larger in children than in adults, and in these than in persons advanced in life. But with premature emaciation of other tissues, glands also waste before their time, and they have been found larger in a well-nourished woman at ninety years of age than in one who at fifty had died exhausted by chronic disease.* In wiry, slender people the glands are small and firm; they are succulent and large in persons characterised by softness of fibre, a thin fair skin, and some embonpoint. Even in the same body the lymphatics differ from one another according to the tissues with which they are associated, the structure or functional activity of the primary organ entailing some corresponding variation in the texture, the size, and even the number of the subordinate lymphatics. There is, for instance, less glandular structure in the course of the absorbents of one of the lower extremities than of one of the lungs, great as is the difference in the bulk of those parts. The largest of all the absorbent vessels are those found in connection with the uterus at the period of parturition. And as in size and number, so are there differences in the texture of various lymphatics. 'The glands of the thigh or arm will sustain a large column of mercury without bursting; whilst the glands on the mesentery, or on the lumbar vertebræ, easily burst.' For 'these last resemble the viscera of the abdomen and thorax, whose texture is much more delicate and tender than that of the external muscles.'*

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* Gulliver's *Hewson*, Sydenham Society's edition.

The transition is imperceptible from an hypertrophy or enlargement of glands, which corresponds with the state of the tissues to one which is strictly morbid; and in practice it is scarcely to be defined. A general fulness of all the glands concurs in some persons with rickets, a large brain, and a hypertrophied thyroid gland. In other cases, the large succulent glands, which are met with in children of soft loose fibre, seem readily to receive the yellow deposit of actual disease. There is also a class of chronic enlargements of the glands, which are occasioned by no traceable inflammation of the afferent lymphatics, and are attended by no pain, and but rare liability to suppuration. They have been described by Dr. Hodgkin in the *Medico-Chirurgical Transactions*, vol. xvii. The specimens preserved in Guy's Hospital Museum are of very large size, one gland alone being three inches or more in length. They are smooth, uninflamed, and entirely free from scrofulous deposit. They are said to have been of semi-cartilaginous hardness, and, on section, pale, uniform, non-vascular, and slightly translucent. They were observed almost universally throughout the body, and accompanied with an enlargement of similar appearance in the spleen. They occurred both in children and in middle life, and they proved fatal by anæmia and exhaustion. Their microscopic character is that of glandular tissue, with excess of the nuclear element. (See the drawing of *lymphoma* in vol. i. plate x. fig. 10.) Sometimes a single gland is thus enlarged, and its texture is so loose as almost to fluctuate. Such glands, as well which are plainly strumous, may by mere bulk occasion inconvenience when lying near ducts, vessels, and nerves. h has been attributed to their encroachment on the hi. I have seen a case thus fatal at seven years of ne side of the neck being greatly swollen with clustered s of large size, which extended into the mediastina, the lung and chest on the same side being diminished. presence in the pelvis is said to be capable of interfering parturition, and when pressing on the trachea they have ioned so much distress that the subcutaneous division of sterno-mastoid has been thought advisable to relieve the thing.*

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* Cruikshank, *On the Absorbents*, p. 71.

hen these cases are excepted, and those which are referred other parts of this essay, there are few slow enlargements e glands left which can be assigned to mere chronic inflam- ion. Some such cases, however, inasmuch as they yield to ild mercurial course, are assumed to be of that nature. The had need be very clear which could admit of such treat- t; but the fact of its occurrence justifies the treatment in s which are unmarked by constitutional disease, or which not yield to the milder measures recommended for the treat- t of scrofula. The mercury should be prescribed in small es, and be combined with some tonic. Quinine and calomel, bichloride of mercury in decoction of bark, the biniodide of rcury in the form of a pill, and calumba, cascarilla, quassia, sarsaparilla—any such combinations may be adopted. Dr. dgkin was disposed to rely on the use of liquor potassæ in the nagement of the cases which he described, but he had no portunity of testing the remedy. The state of the glands in es of rickets rarely rises into importance as compared with other disease. When it does so, it is chiefly on account of ppuration taking place in them, with every indication of strumous character. Local treatment may go on at the me time; ointments or washes of lead, iodine, opium, or of mbinations of these remedies, being continuously applied. listers are to be avoided in glandular inflammations. They cessarily irritate the lymphatic vessels of the skin, and tend aggravate, rather than moderate, an existing inflammation. leathern plaster left constantly on the surface is more effec- e in reducing the swelling, and it may be medicated in any

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* Gross, *Surgery*.

manner suitable to the case; the various emplastra of
Pharmacopœia affording choice enough for that purpose.

Strumous disease in the lymphatics having been selected to il
trate the subject of SCROFULA, it will not be necessary to rep
in this place so much of the description of the glandular dis
as was required for the general article on that subject (vol.
p. 367). It may be observed that the new use of the w
struma by Professor Virchow, to signify bronchocele, sup
renal, and pituitary disease, is not here adopted.

Strumous disease may occur in glands with the inflammati which often succeeds the eruptive fevers of childhood and yo Measles, varicella, scarlatina, &c., are not uncommonly follo by an enlargement of the cervical glands, which may bec chronic, and assume the characters and course of stru Scrofula may also originate in glands, upon some irritation disease of the tissue or organ with which they are connect It appears to be produced in the ordinary way of inflammati of lymphatics, but to be modified by the state of the constituti in which it occurs. Sometimes an injury, far more frequently slight chronic ailment in the skin, occasions an enlargement a gland or glands, the deposition of strumous matter in it, an subsequent characteristic softening, which can hardly be described as suppuration. Many enlargements of the cervic glands may thus be traced to eruptions on the scalp; some t inflammation or suppuration of the ear; others to the irritation of decayed teeth. Again, there are affections of the glands with struma, traceable to primary disease of the same nature in the organ to which the glands are subordinate. Scrofula is thus repeated, after the manner of cancer, in the spermatic and lumbar glands from tubercle in the testis; and, like cancer, too, it will increase in the absorbents, and prove fatal after the extirpation of the organ which was primarily diseased. Bronchial glands are often tuberculous in correspondence with the lungs; a gland over the masseter with the blear eye, or strumous lippitudo, &c.

But there are not wanting cases in which a primary occasion for the disease in the glands cannot be discovered, and in which the cause may be some chronic and undefined fault in the nutrition of the tissues. For whilst, in some instances, only the bronchial glands are tuberculous, there are others in which they only are exempt from the disease. Some patients have only an largement of the lacteal glands, the lymphatics being every-here natural; in others the disease is entirely limited to the eneral absorbents, those of the bowels being healthy. Some atients, again, have a universal disease of the glands. In these stances, the extensive disease can only be supposed to arise om a general cause, as distinguished from a local irritation.

The diagnosis of strumous disease of glands is rarely difficult. n an early stage of their slow enlargement they may in the illa imitate the firm nodular glands which are becoming can-rous, and for some time be difficult to distinguish in women ho, scrofulous in youth, are at the age liable to mammary can-r. But the progress of the disease clears up the doubt. The rge, clustered, movable, tuberous masses of strumous glands the neck, axilla, or groin, can be always recognised to be andular, and there is but one other disease which is liable to confounded with them. Medullary cancer sometimes grows many glands and to a large size, and forms a cluster in the anner of those of scrofulous nature. But glandular medullary ncer without a distinctive recognisable primary growth is ex-emely rare, and in the presence of such a growth the difficulty diagnosis could not occur. In the few instances in which ncer does happen in glands alone, it may at first be but un-rtainly distinguished from strumous disease, by its more rapid owth, its less isolable and softer lobes, its elasticity, and some-mes by its electric pain. The late progress of the cancer to st size, livid elastic protuberances, and fungous bleeding penings, are plainly distinct from the slow enlargement, the allow suppurations, and the flaky puriform discharges of the rofulous tumour. But little assistance can be derived from e age of the patient, as the majority, both of strumous and edullary diseases of glands, occur before puberty. A single rumous gland is liable to be confounded with a hydatid or yst, especially when it has suppurated, and has remained long ncysted. The distinction can only be drawn by the history f the case, the appearance of the patient, and dexterous dis-rimination of the shape of the tumour or of some remaining ortion of the gland.

The *suppuration* of strumous glands, though commonly slow nd immature, is occasionally acute, copious, and attended with apid emaciation and weakening of the patient. This seems to e particularly the case with strumous glandular abscesses in he groin, which sometimes equal the largest orange, and discharge as much as three-quarters of a pint of muddy, ill-formed pus, mixed with large quantities of yellow scrofulous flakes. Even when opened comparatively early, or while yet forming, these acute strumous abscesses are attended with hectic, and a general debility not less severe than that which accompanies the softening of tubercle in the lung.

Far more commonly the abscesses connected with scrofulous glands are remarkable for their slow progress, the occasional variations in their condition, their rather frequent spontaneous removal, their feeble efforts at repair, their burrowing, and sometimes for the copious and even fatal hæmorrhage which they occasion. They appear to be formed outside the gland, and to have therefore one part of their surface, viz. the gland, in a state of disease. The matter in them is not pure pus, at once the effect and cause of vigorous inflammation in the tissues around it, but yellow tuberculous lymph, and a serum so thin and slightly cloudy as to suggest that it may be but lymph from lymph-tubes and cavities in the gland. Sometimes the abscess becomes flaccid, from a part of its contents being absorbed, or removed by the way of the lymphatic vessels; and sometimes the fluid part entirely disappears, leaving only the solid yellow material behind to shrink, and after a long period to become cretaceous. A strumous abscess rarely points; it generally widely undermines and destroys the healthy skin which covers it; it burrows also among the areolar tissues, which, as has been said, do not resent its encroachment, or enclose it by a compact dam of lymph. The opening of such an abscess, therefore, is but the opening of one portion of a sinuous canal. In its deeper parts it may extend to the vicinity of large blood-vessels, and disastrous results may ensue. The internal jugular vein is sometimes obliterated and contracted near such an abscess; two or three inches of it may be entirely removed, and its upper and lower orifices plugged with lymph. Arteries in such circumstances, on the contrary, may ulcerate: and not a few cases are on record in which large quantities of arterial blood have poured from strumous ulcers, involving the internal carotid. Mr. Syme met with such a case, in which the hæmorrhage issued repeatedly, and even after the ligature of the trunk vessel, from an abscess beneath the ear, but was finally stopped. My colleague, Mr. De Morgan, tied the common carotid for profuse arterial hæmorrhage from the tonsil in a case of strumous disease of the higher cervical glands. The patient rapidly and tirely recovered from phthisical as well as the local strumous mptoms under which he had been labouring.

The *treatment of scrofulous glands* is in great part constitu- nal. The disease being of slow growth, and based upon adual impairment of the general nutrition, a rapid improve- ent is not to be expected, and the measures adopted must be ntinuously persevered in for a long period. When it is remem- ered, too, that in some instances external glandular has been bserved to alternate with the far more perilous tubercular dis- ase of the lungs, and that in very many cases the supervention f the latter disease upon the former is fatal, it will be seen at improvement of the health is rather to be desired than the ere removal of local disease. Good air, nutritious food, ample nd cheerful exercise, act imperceptibly but continuously upon he system, and supply the best means of reducing, as the con- rary influences do of originating, scrofula. If, therefore, the omplete removal of the disease and its cause is to be accom- lished, these advantages must not be supplied for a short time nly: the citizen should take up his residence in the country, electing high lands or the eastern sea-coast of our island, in he summer; and either returning to the comforts of town or o a warm locality for the winter. It is an error to prefer mild oist climates. Provided the chest be still sound, it is sur- rising to observe the rapid improvement of scrofulous sores nd swellings, and the high standard of health and bodily igour which is obtained by a temporary residence at Margate. ases of phthisis are at all times injured there.

The medicinal management of strumous glands is amply escribed in the essay on SCROFULA, vol. i. pp. 373 et seq.

The acute suppurations of struma need early evacuation by the knife, as much as other abscesses; and in order to avoid the drain upon the patient's strength which they cause, they should be carefully syringed out and dressed with lotions of gallic, carbolic or sulphurous acid, with iodine, or with solutions of silver, copper, or zinc, and then accurately bandaged and compressed. Their discharges, in fact, must be lessened as much as is consistent with the necessary expulsion of their unorganisable contents and walls. The patient will require ample food and stimulants from the first.

In respect to the treatment of chronic strumous abscesses, little need be added to the general remarks made in the essays on ABSCESS and SCROFULA. It should not be forgotten that some such collections of ill-formed pus, are reabsorbed. An ab advancing to the surface without actually pointing, ma opened and freely and repeatedly syringed out. The pun may then be closed and the cavity compressed, with the of its walls cohering. This is most likely if at the same the plan of Mr. De Morgan be carried out, and the pyo surface be destroyed with a solution of thirty or forty g of chloride of zinc in an ounce of water, and then stripp with the finger. When the abscess has widely undermine integument, the attenuated skin is often incapable of rec It becomes livid, opens, and very slowly ulcerates. Its pr interferes with the free discharge of the matter, and pr the cicatrisation of the abscess. Very much time is save unsightliness spared by the application of caustic to the integument so thinned, as upon the separation of the s the base of the abscess is freely exposed, and its margin i state to cicatrise. Some sinuses, which undermine the need to be laid open by the knife in their whole ext at suitable intervals by limited applications of caustic. majority of such cases will then heal under pressure. (will close if injected with iodide of starch, or if that sub be introduced into them by powdering it on a seton tl In a few persons, however, perhaps including some r gerers, no surgical treatment whatever secures the c of these burrowing fistulous ulcers. They may be slit cauterised, injected, pared along their edges and to thei extremities; yet they will burrow still. Nothing but the nearest joint, a change of residence, or great improv in the general health, proves successful. Massive and pro strumous glands, the presence of which retards or pr healing of the abscess, may be destroyed by piercing the sharp sticks of caustic. Upon the expulsion of the sloug sores become level, and may heal.

Lymphatics in syphilis.—The actions of the lymphatic infected with syphilis supply an important part of the doctrines of that disease, and have been amply described Lee's essay (vol. i.).

Lymphatics in gonorrhœa.—The lymphatics in this sometimes share in the intensity of the local inflam The penis may be covered with red lines, and the i

inflame and suppurate on one or on both sides. This
subject will be found treated in the essay on GONORRHŒA.

phatics in cancer.—For facts connected with cancer in the
, reference may be made to the essay on that subject in
Some additional remarks bearing on diagnosis will be
in the section upon the state of the *glands in innocent*
s.

absorbent gland infected with cancer may contain the
st speck of the disease. I have found under the micro-
n epithelioma a single small spot of characteristic cells
hole field of perfectly healthy glandular structures. But
entirely ceases to be a gland at all. The whole structure
ced by cancer. In certain situations the disease extends
djoining tissues, and involves and destroys all the glands
region. Secondary cancers in the groin, for example,
ng primary disease of the penis or vulva, may thus
inate all the inguinal lymphatic system, and, when they
e, may give an outlet for a copious discharge of lymph.
h a case there may be not only considerable œdema of
t and genital organs, due to the hindered circulation
ymph, but a wasting also, and in one instance an almost
te conversion into fat of glands in the lumbar region,
heir function had been lessened or abolished by the
n of the lower limb. Far more commonly the rule
rved that cancer reproduced in the lymphatics becomes
l throughout the system.

er of the lymphatic glands is rarely difficult to recog-
Some primary tumour claims the chief attention, and
ines the nature of the secondary affection. When the
lar disease so far exceeds that of the primary tissue as
irst observed, it may be distinguished to be scirrhous,
nes by the contracted shot-like tumours to which the
are first reduced, sometimes by their being enlarged,
nes by their being clustered together into an irregular
. The characteristic hardness of scirrhus is more com-
noticed in the first case, since, when scirrhus occupies
art of a gland, the remainder of it may swell and cause
ole to feel comparatively soft; and when it occupies one
e entire glands and grows beyond them, the whole tumour
only so long as degenerative softening in it is delayed.
distinctions of encephaloid cancer of glands are stated at

p. 341, and those of the epithelial form of the disease in vol. i. p. 572.

The first occurrence of cancer in a gland may take place quickly or late after the formation of the primary tumour. In some instances the secondary disease is even observed first; in others, the lymphatics escape infection altogether. Upon what these various facts depend is not known, but it is interesting to observe that they have their parallel in the pathological action of the lymphatics after the insertion of a poison into the body. Sometimes they inflame with great rapidity, and sometimes they are not affected at all. Sometimes their inflammation is delayed, and in the case of the inoculation of small-pox it is not until the seventh day that the glands inflame. The advance of cancer to the glands, and its commencement in them, are almost invariably unnoticed; but in one case of primary and still ulcerated cancer of the hand, the absorbents were first affected with inflammation, red lines suddenly arising on the skin, and a gland enlarging, which soon assumed the character of cancer. The patient was a well-grown womanly girl of fourteen, and the disease of medullary nature, and extremely rapid in progress.

When once established in a gland, cancer usually pursues a course like any other secondary tumour. It may attain a moderate or a vast size; it may be stationary, or may with it may appear dependent or independent on the primary growth or on the growth of other tumours in the body. These are sufficiently stated in the article on CANCER. It may added, that no cases of an universal tainting of the lymphatic system with cancer are observed, as is sometimes the case with tubercle. Cancer appears to travel along the absorbents in a manner which is explicable by the anatomical arrangement of those vessels, and not to affect the system as a whole.

The glands in innocent diseases.—Lymphatics appear to no special relation to the functions of the several parts which they are connected. Organs having only blood-vessels and those provided also with an excretory duct, equally possess a system of absorbents. The glands may therefore be said appended to the tissues, as such, and may be expected to with those tissues in their condition. That they do thus within the limits of health has been already stated in the section *hypertrophy of glands*; and the probability is that they are secutively altered by every morbid variation in the condition the tissues.

In practice, however, such morbid variations are not appreci- le, unless they cause a change in the size, form, or density of glands. So far as surgery is concerned, glands not appreci- ly affected pass for being healthy.

The importance of the question as to the state of the glands various diseases is shown by the general fact already alleged to their implication in cancer, in contrast with their relation tumours which may be classed as not malignant. Although the commencement of cancerous growths the glands are rely affected, yet they are sometimes both early and most tensively diseased, and at some period before death they are most always invaded. Even the bony substance of osteoid reproduced in the glands. An affection of the lymphatics by ny innocent tumour, on the contrary, in the same sense in hich they are involved in cancer, is very rare, probably as rare the case of glands unaffected in that disease. They may ndeed be enlarged in connection with an innocent tumour, but is because irritation of the skin or ulceration likewise exists. uch enlargement is a transient inflammatory swelling, not a eproduction of the primary disease in the gland, and is no ore to be ascribed to the presence of the tumour than if none xisted.

Reserving such cases, I may enumerate the following diseases n which no appreciable affection of the lymphatics is observed: ll simple hypertrophies of any organ or part, and all tumours hich present some likeness to the structure in which they are ormed. Fibrous tumours of the uterus and prostate, there- ore, mucous polypi, chronic mammary tumours, cutaneous hickenings and mollusca, adipose tumours, and exostoses, with ther growths of the same character, are unattended by the evelopment or repetition of the disease in the glands. If cysts hould co-exist with malignant tumours, the glands may be ffected with cancer; but cysts, as such, and cysto-sarcoma, re never followed by corresponding disease of the lymphatics. his fact is observed in the ovary, the os uteri, the kidney, the ubcutaneous structures, the spermatic cord, sometimes in olloid, and, what is of the greatest practical importance, always the female breast.

My colleague Mr. De Morgan[*] had under his care a middle-aged w
whose left breast was the seat of an enormous innocent tumour, and the r
of a well-marked scirrhous growth. The former tumour, growing rapidly,
threatening the patient with speedy death, was removed, and was found t
mixed cystic and adenoid, copiously infiltered with cells and nuclei. The r
axillary glands were extensively cancerous; yet even with cancer thus ex
in the body elsewhere, the glands in the left axilla were healthy.

Some tumours, composed of structures unlike the par
which they grow, are not attended by disease of the same
in the glands. An enchondroma of the femur which I obser
though of vast size and fatal to life, was entirely limited to
bone. In the ischium also a cartilaginous tumour has
known to be unattended by lymphatic disease.[†] The s
fact is commonly noticed in the enchondromata which
in the fingers and the parotid region. Mr. Paget met wit
exception to this rule of exemption of the lymphatics
secondary cartilaginous infection, in a case of enchondrom
the testis.

Tortuous large vessels in the cord were found to be filled with adhere
ments of cartilage, and to lead to enlarged glands, and to a cartilaginous
of the size of an egg adjoining the inferior cava. An outgrowth of ca
protruded from this tumour into the vein, and cartilage, carried perhaps
venous blood, was found in the pulmonary arteries (*Medico-Chirurgical*
actions, vol. xxxviii. p. 247). See also vol. i. p. 533 of the present wo
observations by Virchow and De Morgan on the same subject.[‡]

Fibrous, fibro-cellular, and fibro-nucleated tumours, do
affect the glands; but when, though not adopting the stru
of malignant disease, they assume its clinical character,
may in their dissemination involve the glands. Of my
tumours of bone, it is probably too much to assert that
dular disease is never a part of their natural progress,
like medullary cancers, they are often amputated befor
period at which the lymphatics would be involved. I
however, seen the glands still healthy in a case of recu
myeloid, after amputation of the thigh by Mr. Le Gros
Chronic abscesses in the substance of organs, such a

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[*] *Pathological Transactions*, 1868, p. 394.

[†] Bennett, *On Cancroid*, p. 110.

[‡] 'M. Velpeau a présenté à l'Académie de Médecine (séance du 2
1824) un encéphaloïde du testicule, avec des trainées cancéreuses le l
cordon spermatique, et un caillot d'apparence fibrineuse dans la veine
quatre travers de doigt environ au-dessus de la naissance des deux veines
Le caillot était formée de matière encéphaloïde non ramollie.'—Kuhn,
médicale, 29 juin 1861.

metimes confounded with more important tumours, do not casion an enlargement of the glands. An hydatid cyst may covered with extremely large lymphatic vessels, yet occasion disease of the subordinate glands. In an instance of a mour in or near the female breast, which contained echino- cci, and which had been suspected to be of malignant nature, e glands were entirely free from disease. A considerable largement of the inguinal glands took place in the course of case of extremely rough osteo-arthritis of the hip-joint, and as attended with œdema of the limb. The intercurrent glan- ular affection subsided during prolonged rest. In such a case r. Hatherley's), the shoulder-joint was affected, and enlarged ands in the neck for a considerable time simulated a sub- avian aneurism.

Pyæmia is not necessarily attended with inflammation of lym- hatics, but there are a few general diseases in which those parts o share. These only of them, in addition to those which form he subjects of the present essay, may be mentioned: variola, accinia, typhus, plague, hydrophobia, glanders, and farcy. I ould add a few remarks upon ulcers and erysipelas.

Ulcers.—The glands above old ulcers are often found enlarged, nd, on some occasions, tender; but they rarely need attention, nd little, if anything, is known of the results to the glands rom chronic ulcers of the bowel or uterus. When an ulcer, owever, is situated near or connected with any form of tumour, nlargement of the glands, though only such as may attend any lceration, may give to the case the semblance of cancer. No onclusion as to the cancerous nature of such an ulcer should be formed upon the ground of co-existent disease of the glands, without considering the amount of irritation of skin, and the character of the ulceration. By rest, a proper posture of the ulcerated part, and appropriate soothing or other treatment, such enlarged glands will often subside. I have known this to occur when the ulcer existed over a vast cysto-sarcoma of the female breast, and even when the primal irritation was an inflamed state of common carcinoma of the mamma. On the other hand, cancer does sometimes come on in a chronic ulcer, and then produces a very great enlargement of the glands.

Erysipelas.—The exanthemata which extend over the whole integument of the body, as scarlatina and rubeola, do not perceptibly affect the lymphatics; but almost all limited inflammations of the skin are accompanied with some degree of tenderness

But when erysipelas originates at a wound, sometimes swollen and tender before any blush ca on the skin. They are stated to have been fo enteritis, which was recognised as erysipelat almost invariable occurrence of adenitis at the of the disease goes far to support the opinion inflammation of erysipelas is in the lymphatic cases except those treated of in the section on *the absorbents*, the glandular affection is transien no special treatment.

Morbid contents of lymphatics.—Since it is healthy function of the absorbent system to rece discharged into its radicles by the tissues, it h disease also morbid substances find their way in frequently seen in the absorbent vessels of the pe fatal uterine inflammation. It was found, too, in tortuous lymphatic vessels, as large as iliac a walls of a vast hepatic hydatid cyst.† Virch remaining in an axillary gland some cinnabar, w inserted by tattooing in the skin of the arm fif death. Similar but less remarkable facts have be Lapidaries have the lymphatic glands near the with earthy concretions, which are supposed inhaled stone-dust. Poncy saw the thoracic glands full of a cheesy substance. Perhaps the

uctions and obliterations of the lymphatic vessels.—When
ley Cooper tied the thoracic duct in the necks of some
ıe receptaculum chyli burst, and a copious extravasa-
lymph took place. A similar result was once observed
human subject to follow a more slowly formed obstruc-
disease,§ a fatal peritonitis ensuing upon the escape of
through the rent into the peritonæum. The museum of
Hospital contains a specimen of a lacteal larger than a
egg behind a diseased mesenteric gland. In the same
ı is a thoracic duct completely compressed at its upper
ty by cancerous cervical glands. The duct is not at all
; but as there is another mass of cancer in its imme-
icinity near the pancreas, it is not improbable that the
as well as efflux, of lymph through it was hindered.
ni, attempting to inject some pulmonary absorbents,
he bronchial glands so obstructed that the mercury
burst the vessels than traverse the glands. Sömmer-
ithout accounting for it, relates the instance of a robust
suffering from anchylosis of the knee, in whom the
nts of the thigh were varicose, and so tensely filled
on being pricked, their fluid contents spirted violently
nd that the foot was affected with a kind of œdema.

icose condition of a lymphatic vessel may possibly arise
ıother cause than its obliteration, contraction, or com-
ı. There may be a regurgitation at the upper orifice of

a thoracic duct, figured but unexplained by Cruikshank which the vessel is greatly enlarged and tortuous. Its diam is nowhere less than four times its natural size, and, b increased in length as well as in calibre by the great pow weight of the stream within, it lies in many closely adjoi loops, which stretch to and fro across the vertebræ.

The *excision of glands* is rarely required, except in of cancer. A single gland in a state of chronic enlarg sometimes becomes troublesome, and may be taken Occasionally a tumour is removed from the axilla or which has been of long duration, and recently painful convenient, and which is found upon excision to be a cl strumous glands, or a single one enclosing a little pus. once removed from the neck of a middle-aged strumous a small chalky tumour, which proved to be a degenerate But it is long since surgeons have given up deliber moving masses of strumous or merely enlarged glands knife. The large tuberous clusters of absorbent gland necks of scrofulous subjects seemed to invite that tre but when once undertaken it was found to be so for gland after gland presenting itself for extirpation as t superficial were removed, that the operation was ofte doned before it was completed. It rarely had any is that of early death by the development of phthisis in th

The extirpation of cancerous glands proceeds on t grounds as those on account of which the primary tu removed. It is not necessary to repeat in this place t and arguments by which this rule of practice has be ported in the essay on CANCER. The necessity of tak the whole gland and the tissues surrounding it is a It is not enough to open the fascial sheath, in which such sometimes become embedded, and merely enucleate th clear halo of healthy structures should be removed wit The difficulty of effecting this probably goes far to expl fact that little success attends the extirpation of the and higher cervical glands, as compared with those axilla; and the cases are comparatively very few in whi proper to attempt it in the groin and neck.

CHARLES H. MO

DISEASES OF THE VEINS.

N HUNTER was the first to describe inflammation of e lining membrane of veins.* Aretæus † had long before d to some such disorder; but the disease he told of was defined, that no one profited by or sought to advance his idea. Century after century surgeons continued to puncdivide, and excise veins, fearless of the result and innocent eir inflammation. Troublesome symptoms, it is true, times followed these operations; but they were referred to s, tendons, or fasciæ—anything rather than the veins—rves more especially.

was called in haste,' says Ambroise Paré, 'to see his Majesty.‡ He had let blood by a surgeon, and a nerve had been wounded in performing the tion, at which the king cried out with pain. The arm became contracted, the pain diffused throughout the entire limb. I applied a plaster over the d to assure its closing, and bathed the part with warm turpentine and its of wine to allay the irritation, the arm being bandaged to the shoulder, after a time the symptoms began to abate.'

Gangrene, he further states, may attack an arm after venesection, and may prove mortal. 'I have known a lady to d writes Dionis, 'from diffused inflammation of the limb a a bleeding from the foot.'

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* Phlebitis, so named by Breschet, from the word φλέψ (φλεβός), which was ployed by Hippocrates to designate the channels which conveyed fluids, the artery having reference to the air-passage alone. Thus, under the name veins were included the various secretory canals, as the bile-ducts and the ters; and hence Celsus wrote 'a renibus singulæ *venæ*, colore albo, ad icam feruntur: οὐρητῆρας Græci vocant' (*De Re Medicâ*, lib. iv.). Praxagoras t distinguished veins from arteries; for Aristotle, though he gave the name aorta to the vessel which still bears that title, continued to write of it as s of the veins. See Galen *de Hip. et Platonis Dogmatibus*, lib. vi. c. 10; alen *de dignoscendis Pulsibus*, lib. iv. c. 2; *Le Système veineux*, par le Docteur Verneuil, Paris, 1853.

† Κεφ. η' περὶ τῆς κατὰ τὴν κοίλην φλέβα ὀξείης νούσου. Sydenham edition, London, 1856.

‡ Charles IX. of France.

Paré, treating of varices,* observes: 'sometimes in the li they contain a thrombus of blood, dry and hard, which, the being opened, should be evacuated.' Petit writes a descri of the formation of clots in obstructed veins, and of some changes they subsequently undergo.† Discussion was respecting other clots or polypi (*polypes veineux*), as they termed, which were found in the heart; and between H Morgagni, and A. and J. Pasta, opinions differed as t manner and time of their formation.‡ Langswert wrote ' flammatione venarum' in the section of his work, *De Morb riarum et Venarum compositis*,§ but beyond the suggestiv made no advance upon the subject. Attention, howeve been thus drawn to the ill consequences which occasi followed wounds of veins, and the formation of clots in canals was recognised in connection with varices an obstruction.

Meckel, Frank, and Sasse followed Hunter in describi flammation of the inner coat of veins; and from their fi disease (divided into the adhesive and the suppurati been amply illustrated by numerous observers, and b more clearly than by Gendrin, who thus describes its anatomy.‖

He finds the inner tunic of an inflamed vein at first of a more or red colour; but the evidence derived from this condition is often valu the attendant blood-staining. On separating the inner coat from th which can be done more easily than in the healthy state, the injected c become evident, even in the structure connecting the inner with th coat. After a while the inner coat becomes uniformly red, and is l parent, so that vessels beneath are no longer distinguished. It ha d even has become somewhat rough. It acquires, if the disease pro- swollen and villous appearance, and, but for its easily tearing, can be tached from the middle coat. The latter quickly thickens, so that the sembles an artery, but is less resisting. The external coat is also nd infiltrated with serum or blood. The cellular sheath becomes so that the whole forms a blended blood-stained mass. A membrane s lines the vessel, of little consistence, forming a cheesy pulp when etween the fingers.

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* *Œuvres complètes d'Ambroise Paré*, par J. F. Malgaigne, tome ii et seq.

† 'Sitôt que le tronc des vaisseaux est entièrement bouché par l caillot, le sang qui remonte par les branches se coagule à mesure qu'il tumeur augmente et devient plus dure.' He then describes softenin tumour thus indurated, which he ascribes to separation of serum from 'c'est cette sérosité qui fait la mollesse.' *Traité des Maladies chir.* to 42.

‡ J. Pasta, *De sanguineis Concretionibus*, Bergami, 1786.

§ Pragæ, 1763.

‖ *Histoire anatomique des Inflammations*, tome ii. p. 16.

however, has observed this membrane firm and resisting, and even , though but slightly adherent to the adjacent wall. Sometimes it o firmly that it cannot be completely detached, and it occasionally great extent of vein-wall, as in a case described by Chaussier,* in e left renal and adjacent veins were thus coated. The blood now forms all of the vessel fibrinous clots, more or less decolorised, by which the omes blocked up. These clots are not formed at once, but 'fresh layers are continually being added, and in a proportionately very short lug is formed which fills the entire calibre of the vein.'

fibrinous coagulum extends both above and below, far beyond the the portion originally inflamed; the plug, however, ceasing by degrees de up of concentric layers, gradually passes into a tapering coagulum, less tinged with the colour of the blood, and little, if at all, adherent walls of the vessel. In all the branches of veins which immediately the plugged portion, save those which have other channels by anasto- he blood stagnates and coagulates. The plug is shorter above, and extends beyond the point of junction with the nearest venous trunk.'†

h is an account of changes which are said to accompany ve inflammation of veins. In a word, their inner and coats become inflamed, lymph is exuded upon and clings surface next the blood, the latter coagulates, and so the filled partly with lymph and partly with clots. Then, as ry other inflammation, the mingled products undergo r changes.

s, however, difficult to receive these statements in the face ts which throw doubt upon the existence of an adhesive tis. First, be careful, suggests Ribes, to distinguish all dness of the lining membrane of veins from post-mortem stion. Veins, after death, quickly become stained by the adjacent, more rapidly in some cases than in others. discoloration is uniform, and, especially in small vessels, ls to the surrounding tissue, and this more particularly dependent parts 'in inflammatory subjects from the ready separation of decolorised fibrinous concretions, in others from disseverance of the corpuscles.'[*] Many have been misled by this discoloration, easy as its recognition may appear; for example, those who regarded phlebitis as the principal seat of erysipelas; and Ribes himself, when he wrote of an inflammation involving the roots of the portal vein of all persons dying with adynamic fever. Those also who assert that they have seen a phlebitis extending through many veins until it reached the heart, are equally deceived by this post-mortem staining.

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* *Revue méd. française et étrangère*, 1825, tome iii. p. 9.

† Hasse's *Path. Anatomy*, English trans. p. 14.

The experience of Guthrie,[†] who doubts the existence of an adhesive, or, as he terms it, a healthy inflammation of veins, is opposed to Gendrin's description; and Travers,[‡] whose statements, by the way, are contradicted by Bichat,[§] concludes that 'the internal coat of a vein is, when compared with an artery, difficultly susceptible of adhesive inflammation. Indeed, the process of healing and division by ulceration seems to be conducted without any sign of inflammatory action; but the indisposition of the venous membrane to inflame is not, as appears to me, inconsistent with its tendency, under adequate excitement, to inordinate and excessive inflammation. It is not unusual to find the morbid action of parts that are difficultly roused least controllable when once set up.' Frank and Sasse saw matters very differently. They observed a deep redness of the internal coat diffused throughout the vessel, and after ligature 'a sort of false membrane, resulting from the matory action.'[||]

Cruveilhier[¶] observed that vascularity was not seen in the lining membrane of veins, even when the blood charged with irritants from inflamed parts caused an inflammation; for 'I do not regard the phlebitis as the first change, but consider the coagulation as anterior to the phlebitis.' Hunter[**] thought it difficult to conceive 'how adhesions should take place on the internal surface of veins; since it is most obvious that the

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[*] Gendrin, op. cit. tome ii. p. 5; Ribes, *Revue méd. française et étrangère,* tome iii. p. 5. 1825.

[†] *A Treatise on Gun-Shot Wounds,* 3rd edit. p. 299.

[‡] *Surgical Essays,* part i. p. 255.

[§] *Anatomie pathologique,* dernier cours, chap. xiv. p. 266.

[||] *Sylloge Opusculorum selectorum; dissertatio Hallæ habita anno* 1797, p. 16. Also Frank, *Epitome de Curand. Hominum Morb.* lib. i. p. 187.

[¶] *Traité d'Anatomie pathologique générale,* tome i. p. 290.

[**] Hunter, *Works,* vol. iii. p. 584.

gulable lymph thrown out by the exhalants on the internal
ace of the vein, mixing with the same fluid circulating with
other parts of the blood, would be swept away without pro-
ing any effect. But since such adhesions do in fact happen,
coagulable lymph must undergo some change connected
a the disposition which produces its extravasation.'

ravers was the first to show that veins, after ligature or
sion, repair without an adhesive inflammation. Three pre-
ations illustrate this fact. One, in the museum of St.
mas's Hospital,* is thus described: 'Appearance of a vein
ded by the ligature, which came away on the twenty-fifth
. The upper part of the vein is filled with firm layers of
gula, which so tenaciously adhered to the inner membrane
o be separated with difficulty; when separated, the surface
found to be perfectly smooth and natural.'† The second
paration shows the result of a ligature applied to the jugular
n of a horse for twenty-four hours. The inner vein-wall,
own into longitudinal folds, is otherwise natural in appear-
e, whilst a good deal of lymph is accumulated externally
und the ligature. The third, which, with the preceding, is
the museum of St. George's Hospital,‡ shows the effects of
igature, including part of the parietes of the jugular vein of
orse. Some fibrine is deposited in the track of the thread
d in a small pouch below, but no evidence exists of any
lammation of the lining membrane, and this three days after
plication of the ligature.

In the museum of St. Thomas's Hospital § is a preparation of
e jugular vein of a horse, with a circular aperture formed by
eration of the wound made in phlebotomy. Its internal
rgin and the surrounding membrane is coated with adhesive
tter. As in this case the interior of the vessel communicates
th the tissues outside the vein, the adhesive material may
ve made its way into the vessel from diseased tissues which
rround it. But, respecting this presence of adhesive material
ithin veins, an error was originated and perpetuated by the
periments of Gendrin. 'Should any imagine,' writes Hasse,
this false membrane to be not the product of plastic effusion
rom the coats of the vein, but an immediate deposit from the

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* Series v, 151.

† Travers, *Surgical Essays*, plate xiii.

‡ Series vi. 173, 193.

§ Series v, 152.

blood, let him refer to the experiment of Gendrin. Having secured a portion of an artery between two ligatures, and entirely cleansed it of blood, that experimentalist discovered, after throwing in an irritant injection, a plastic membrane deposited within the part so insulated, filling up the whole calibre of the vessel; and he affirms that similar results followed in experiments upon veins.' Notwithstanding the credit this view long obtained, and the support it received from authorities in this country, its accuracy was disproved by Lee. Having found that inflammation of the coats of the veins only occurred when the blood had previously coagulated in them, he was induced to believe that the deposit found in the veins might be derived directly from the blood. Gendrin's experiment was, therefore, repeated; and when precautions were taken to exclude all blood from the vessel, no lymph was effused in the vein.

In repeating this experiment, I find, however, that lymph is occasionally found within the veins, but that its presence is due to an effusion external to the vessel. The precaution of closing, by ligature or otherwise, the opening through which the irritants are introduced, effectually secures its absence. The following experiments show the result as this precaution is, or is not, taken. They show that the lymph, when present, finds its way into the vein from without, and is not exuded from it through the lining membrane. Neither, in animals, does the internal coat inflame when irritated.

1. Part of the femoral vein of a dog being selected, free from anastomosing branches, a ligature was applied so as to stop the blood coming from the extremity. The vein was then opened by a longitudinal incision, and the blood in the vessel was removed. A second ligature was then applied between the longitudinal cut and the first ligature, and a third was tied between the wound and the heart. After twenty-four hours, lymph was found in the latter space, but not in the first. There was also an abundant deposit of lymph external to the vessel.

2. Part of the femoral vein of a dog having been included between two ligatures, was punctured, all blood removed from its interior, and two small pieces of lead introduced within the portion of the vessel isolated by the ligatures. Twenty-four hours after the operation the vein was surrounded by lymph, a considerable quantity of which had entered the vessel through the puncture distending its canal, as may be seen in the preparation.

3. The femoral vein of a dog having been exposed, an experiment was made which resembled the preceding; but the ligature nearer the heart was added after introduction of the foreign bodies, so as to cut off the portion of vein in which the pieces of lead were included from communication with the puncture in the wall of the vessel. The lining membrane of the portion of vein

ted presented a natural appearance twenty-four hours after the opera-

mall piece of lead was introduced within the femoral vein of a dog suspended by a thread, as seen in the preparation. The puncture in wall was then closed by a ligature, which had the effect of slightly g the canal of the vessel. The blood was then allowed to flow through for forty hours. At the end of this time the lining membrane of the tained its natural appearance.*

m these considerations it is manifest that adhesive phle- has been very variously described and accounted for, at its occurrence has been denied by some pathologists. can be no doubt but that veins are repaired without its d experiments upon animals, taken for what they are , show that the lining membrane of these vessels does not e when irritated. Absence of vessels from this membrane , one would think, a reason for its immunity. A tissue circumstanced may eventually be involved when adjacent are affected, but it rarely originates disease. As the er between tissues often inflamed on the one hand, and the d-stream on the other, it would obviously discharge an rtant function did it prevent lymph from being effused on internal surface of the vein. For although this lymph might swept away without producing any local effect, it could not mingled with the blood without risk of spoiling that fluid, of causing secondary mischief by becoming entangled in, and obstructing, the capillary vessels.

I prefer, therefore, to consider what has been termed adhe- ve phlebitis under the name of thromballosis.

THROMBALLOSIS.

The changes which result from *coagulation of blood* within he veins (thrombus, as Petit terms it †) may easily be mistaken or processes of an inflammatory character, unless the beginnings f the disease are accurately observed.

Causes.—As it has been elsewhere shown ‡ that the blood- ibrine, under certain conditions, is apt to coagulate sponta- neously within the vessels, it will here suffice to recall the fact. Coagula may indeed form, as a means of repair, be the blood condition what it may. They do so in arteries after application of a ligature. They do so in veins when wounded or when torn across, and are then sufficient to close the rent, and eventually to repair it. In these cases the coagula are limited in their extent. But in other cases, and to these our attention is now directed, when a clot is formed within a vein, it increases and extends from one to another, until having commenced perchance in a vessel of small size, it reaches and fills the largest.

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* Museum, St. Bartholomew's, series xiii. 156.

† Also named *embolism*, from ἔμβολον, a plug. The term *thromballosis* more correctly indicates this disease (θρόμβος, a clot, and ἀλλοιόω, to change).

‡ Vol. i. p. 275.

This remarkable tendency of the fibrine to coagulate within the veins may exist, unsuspected, in the ill-nourished and feeble, or may be slowly induced during the progress of disease. Some trifling circumstance is then sufficient to call it into action. Bouillaud states * that those dying from phthisis or from cancer often suffer from the formation of clots in veins.

In one case the external iliac was thus filled with a coagulum when compressed by intestine distended with fæces. In another, a tumour pressed the vena cava; in a third, a cancer growth the internal iliac; and where the pressure fell, there each vessel was closed by coagulum.† In the body of a young man who had long lain in one of the wards of St. Bartholomew's Hospital with his thighs drawn up on the abdomen, the femoral veins were closed by clots above the junction of the profunda, and as high as Poupart's ligament. The mere flexing of the vessels had sufficed to determine the coagulation, as he slowly died with phthisis of the lungs.

The circumstance which called the coagulating predisposition into activity, seems, in these cases, to have been (1) the pressure upon the vessel. So again in the following case.

On December 6, 1860, I examined the body of a male patient who had long suffered from dilatation of the pelvis of the right kidney, in consequence of impacted calculus. Pericarditis was the immediate cause of death. The vena cava inferior was compressed by the dilated pelvis (which formed a cyst holding four pints of fluid), and was somewhat narrowed above the junction of the common iliac veins. The right common iliac was filled by a coagulum in part soft and blood-stained, decolorised where in contact with fluid blood coming through the opposite vein. It extended far towards the leg, even to the vein about the middle of the thigh, and the right lower extremity was œdematous.

In these cases, the pressure is often slight, and generally acts upon one side of the vessel, the vein being free to yield in the opposite direction. They must be distinguished from those

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* *Traité clinique des Maladies du Cœur.* Bidault (*Recherches sur les Concrétions sanguines des Veines*, Paris, 1850) states that Legroux first drew attention to the spontaneous formation of clots in veins.

† See cases by Forbes and Holberton in *Med.-Chir. Trans.* vol. xiii. p. [illegible] vol. xvi. p. 62; also Museum, Guy's, 1523⁵⁰.

s in which the pressure is made upon the whole circum-
nce of a vein, or if acting on one side, compresses the
el against a resisting substance such as bone. The vein is
filled with a coagulum distinct or mingled with an in-
wth from any tumour which may happen to surround it, and
ntually, if the vessel become obliterated, clots form on the
al side of the obliteration, just as after application of a
ture.

his occurred, for example, in the case of a woman, aged twenty-three years,
suffered from osteoid cancer, involving the lower part of the left femur and
popliteal space. The limb was amputated at St. Bartholomew's Hospital.
diseased portion was examined November 23, 1861. The popliteal veins,
e were two, were obliterated, and could not be traced amidst the substance
he tumour; but above and below the obliterated portions the vessels were
d with firm colourless coagula.

Other circumstances, however, more often determine the
mation of coagula. (2.) Inflammatory changes in the tissues
ich surround veins. Thus at the base of an extending ulcer
e veins are filled with coagula.* As the disease advances,
e clotting goes before, and plugs portion after portion of
jacent veins. Rendered solid, they may indeed soften and
ugh as the disease progresses, but hæmorrhage is, as a rule,
evented by their previous obliteration. (3.) Laceration of a
in, as when the placenta is expelled from the uterus. Some
ood escapes and coagulates without, and some, but not much,
ithin the vessel, which is itself contracted. Thus, and by sub-
quent changes, the vein is permanently closed. The exten-
on of clots, which results in either of these circumstances,
hough of common occurrence, has received scanty attention.

In illustration, I will narrate two or three cases.

In the body of a man brought to St. Bartholomew's for dissection, death
aving resulted from phthisis, the nates were covered with sloughing sores.
he left femoral, just below Poupart's ligament, was filled with a firm coagulum
which ascended to the junction of the epigastric vein. Attention was drawn to
umerous veins about the base of the sloughs, which were more than usually con-
picuous from being distended with clots. They converged towards and formed
the left internal circumflex, and so extended direct to the femoral; and, without
doubt, accounted for the clot which had formed there in direct continuity with
those in the smaller vessels.

In February 1864 a woman, aged twenty, died, after amputation of the thigh,
with symptoms of pyæmia; there was no evidence of vein obstruction about the

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* Museum, St. Bartholomew's, series xiii. 61; Middlesex, vi. 52; St George's,
series vi., Nos. 176, 177, 178.

vessels of the thigh, but on making a careful examination of the pelvis, to which I was led by the fact that a large bed sore had formed over the sacrum, a firm plate of fibrine was found at the junction of veins to form the right common iliac. This fibrine partly hindered the flow of blood from the external iliac, but being broken away from the mouth of the internal iliac, had allowed a quantity of old clot débris to pass into the circulation, this came from the ischiatic vein, which was filled throughout its entire length by old and softened coagula. The lungs were filled with secondary deposits. In this instance the thromballosis had extended in the veins about the sore on the sacrum, not from that about the amputation wound of the thigh.

My friend, the late Dr. Baly, sent me the following report of the case of a female aged sixteen years, a prisoner in Millbank. On January 20, 1844, she was placed on the sick list. She was of a strumous aspect, and had suffered from attacks of diarrhœa and of dysentery, attended with pain about the head and cramps. The day following, the cramps ceased. Pain and tenderness about the epigastric region persisted. The third day she began to complain of pain in the right side of the head, and the right side of the face was slightly swollen. The gums were somewhat affected by mercury she had taken. A glazed red streak extended from a pustule on the right side of the nose to the inner angle of the eye, terminating abruptly. A good deal of the pus had discharged from the pustule during this and the preceding day. The fourth morning she was seized with convulsions of an epileptic character. She became insensible, and on the fifth day she died. The body was examined twelve hours after death. The right cavernous sinus was filled with clots and puriform material, as also was the ophthalmic vein. Elsewhere, each sinus contained dark fluid blood. Two veins, one from the dura mater, the other from the brain, were filled with clots. The vein by the side of the nose also contained coagula. Part of the brain lying over the cavernous sinus was ecchymosed, the blood was coagulated in its vessels, and its tissue softened. From the pustule to the softened brain tissue the progress of the disease was distinct, and not to be mistaken.

Examples to show how veins, after wounds and rupture of their walls, become obstructed with clots, may be taken from those cases of œdema of the legs, so often following parturition, bad fractures, and even severe contusions.

On July 19, 1855, a woman, aged twenty-four years, was admitted into St. Bartholomew's Hospital, who had enjoyed good health until, about six months before, she had fallen from a height, and severely bruised herself about the pelvis. Two months after, she was confined at the full time. A few weeks before she had noticed some swelling of her legs, and she subsequently suffered from obscure abdominal pains, with occasional hæmorrhage from the vagina. Her emaciation became extreme. The lower extremities became permanently œdematous, and hard cords could be traced along the course of the principal veins. Exhausting diarrhœa baffled treatment, and, sinking gradually, she died about eight months after her confinement. The femoral and all the iliac veins being removed after death, presented the following appearances. In places they were greatly distended, firm, and resisting. Between such portions they were contracted and empty. All smaller veins opening into these trunks were occupied by firm, decolorised clots. The tissues around were natural, save about the femoral veins, where they were somewhat thickened. The coagula pretty firmly to the walls of the vessels; they showed an arrangement of tric layers, easily separated one from another. At the contracted points, alls, as elsewhere, presented a natural appearance. All other parts of the ly, excepting the œdematous legs, presented a natural appearance.

ain: a woman, aged sixty-two years, died in the same hospital, forty days a comminuted fracture from direct violence about the upper and middle of her right femur. Her death resulted from exhaustion; she sank gra- ly, with extensive bed sores. The right lower extremity was slightly atous. Great ecchymoses were found about the adductors and the vastus nus. The profunda and its formative branches were plugged as high as the tion with the femoral vein with softening blood-stained clots, of the exist- of which there was no suspicion during life. The fractured femur re- ed ununited. The important relation between these clots and the occur- of non-union will be subsequently noticed. The predisposition which es the blood to form these continuous clots is thus called into activity by ents of common occurrence.

he *coagula extend* in all cases in one of two directions—(*a*) inst, (*b*) with, the blood-stream. To assist in explaining ir extension, the formation of a coagulum in an artery on ch a ligature has been tied, must be referred to. It is thus iced by Jones:

> rom these circumstances it appears that the enlargement of the portion of artery between the first collateral branch and its extremity is prevented; it is obvious that there must be a small quantity of blood just within the mity of the artery, and which is more or less *completely at rest*; it *there- coagulates*, but does not appear in every instance to form a coagulum capable lling up the canal of the artery; for, as may be observed in many of the riments, several hours after the artery had been tied, there was only a slender ulum formed in its extremity. I am therefore disposed to think that gh the artery cannot accommodate itself to the blood determined to it, yet it ergoes such a degree of contraction, as occasions too much motion in the d which it contains to admit at once of its complete coagulation. It is a that in most cases only a slender coagulum is formed at first, which gra- ly becomes larger by successive coagulations of the blood; and for the reason it is that the coagulum is always at first of a tapering form, with ase at the extremity of the artery.*

he researches of Stelling† add little, if any, information. observes, that the arrested blood forms a conical mass, se apex is near the first lateral branch, and whose base is ted on the extremity of the vessel, and is contained within nnel of blood in partial motion.

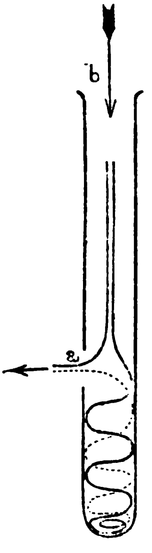
ow respecting this coagulum (thrombus) two facts deserve

On *Hæmorrhage*, p. 159. See also Halleri Op. Min. t. i. exp. 54. 'Sensim de arteriâ ligatâ sanguis collectus ita refugit ut nullus supra vinculum uis maneret, sub lino vero copiosior et stagnans superesset.'

Die Bildung und Metamorphose des Blutpfropfes oder Thrombus in verletzten gefässen Eisenach, 1834.

to be noted. The first is its formation independent division of the middle and internal arterial coats. If a ligature is tied round an artery so as to close its canal out lacerating the coats, a clot is readily formed betwe ligature and the first branch on the cardiac side.* The fact is that the blood is not stagnant above the ligature, to say, in a state of rest, as is usually assumed. On th trary, it is agitated in an orderly manner, so that the is as it were churned out of the blood to form the coa This may be illustrated by the following experiment. opening (*a*) be made in the side of a common glass tes Between this opening and the closed extremity of th let the latter be filled with sand. A stream of water d through an elastic tube adapted to the (*b*) of the glass will quickly remove the part of the sand through the lateral ou What remains will assume a spiral shape the particles of sand as they are whiske will indicate a spiral movement of the stream, as shown by the plain and dotte in the annexed diagram. As the relati varied between the velocity of the stre diameter of the outlet, the diameter of tl and the distance between the closed ex and the lateral opening, so of course result be modified.

Fig 151.



It is in the midst of such an orderl ment, that fibrine is probably separat the blood above a ligature and forms tl and conical clot, which extends to t lateral branch (where the churning m ceases), and which, consisting of s fibrine, is from the first colourless.†

Under like circumstances, clots form and extend in structed vein (Fig. 152, *a*) in opposition to the stream the first branch, as at *b*, where the blood turns back thr collateral vessel (*c*); they also form where the blood tates, as in the subclavian vein from disease of the hea agula are produced less rapidly than in arteries, and rine is often largely mingled with other blood con-. The blood also finds into the vein on the side of an obstruction supposing vessels (*e e*) rn across, what with nal clot (*f f*) and the ion within, as at *d*, soon plugged to their with a larger vessel. of the clot in contact e blood-stream, if in a in which opens into one size, is round or flat-f, on the other hand, it the large vessel, its extremity, moulded by the lateral is tapering, or otherwise modified in its shape.* Be-y such point the extension of the clot depends, as y Virchow, upon deposits from the blood as the latter er the coagula, and these additions of fibrine may be l in orderly layers (*g*), or may be deposited irregularly, a rough surface, as at *h*.† By these accumulations the eins may be so nearly occluded that a slight additional ion at any moment completes their closure. Vessels gged present the appearance shown in Fig. 153 (from ructed profunda vein), the yellowish or white clot, as is usual a spiral shape, and coloured coagula filling spaces (often speckled with fragments derived from

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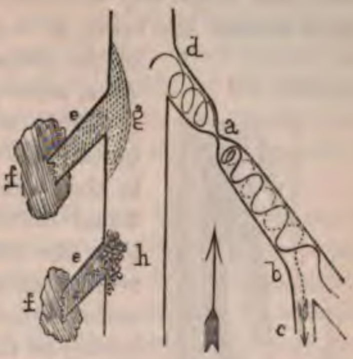
* Museum, St. Bartholomew's, series xiii. 141.

† Reference is made to these observations in the article *Venen* O. Weber in the *Handbuch der allgemeinen und speciellen Chirurgie*, p

‡ Guy's Hospital Museum, 1521^{30}.

FIG. 152.



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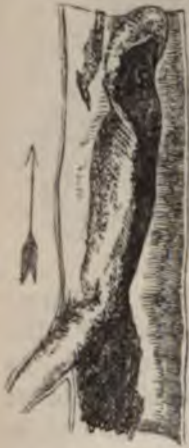
oodcut, vol. i. p. 276; also Museum, Guy's, 1521^{22}; Middlesex, vi. 52.
rom these projecting coagula that fragments and even large masses ed, pass into the blood-stream, and are carried by it to be eventually distant organs. Several cases are recorded in which sudden death has d by the lodgment of such a fibrine mass in the pulmonary arteries; uences of their arrest in the arteries of the brain, whither they are rried from deposits on diseased valves of the heart, have been fully d by Kirkes; and the whole subject of occlusion of the arteries cause will be found treated of in the following essay. Plate viii. o Davis's paper in *Med.-Chir. Trans.* vol. xii., and preparation Guy's Hospital Museum, are excellent illustrations of coagula in a be thus washed off by the blood-stream. See also recent observa-Bastian and others, and by Tuckwell in *St. Bartholomew's Hospital* ol. v.

the fibrine masses), the whole bearing below an impress the vein-valves.

FIG. 153



The changes hitherto described, although as often in dent, are frequently associated with ordinary inflamma parts around the veins, as may be seen in the greater n of the preparations in the London mu As a consequence of such inflammati so-called adhesive phlebitis), small quickly fill with clots; and if a mai is then examined, its inner surface found dotted over with what at fir look like plates of lymph, but which reality the clots projecting from the veins, some firmly attached, some l loosely in the canal. From these, as points, the main vein becomes in t structed with coagula, more especiall outer walls are implicated in the inf tion, the clots having often a regula nated arrangement. At the first larg which joins the affected vein the clo arrested by the incoming blood-strea if, as has been already shown, the disposition to clot-fo is strong, it is only checked at the junction of collateral and may extend with scarcely any limit either towards from the centre of the circulation.

When these clots are removed, the lining membrane vein beneath presents a natural appearance; but its ou middle coats are not unfrequently thickened, and if t much contraction of the tissues around subsequent t inflammation, the vein may be thrown into longitudina or may become tortuous.*

As each coagulum is formed, it contracts; and i happens, being firmly fixed by its roots, as we may te prolongations into the small branches, that the vein- drawn with it in its retraction, becoming condense thickened in appearance, so much so that when cut ac resembles an artery. Indeed this condition is generall taken for an inflammatory thickening of the vessel; but case of the young woman narrated at page 361, suspecti

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* Museum, College of Surgeons, 1725.

repeating this experiment.
imes the coagulum shrinks to one side, being more
eld by the branches in that than in the opposite direc-
l under favourable circumstances the blood, incessantly
uring to insinuate itself into the obliterated vessels,
n a channel by the side of the clot between it and the
ll, or in rare instances (referred to by Ribes and others)
ill for itself a passage through the centre of the clot.
such circumstances the circulation is re-established,
still hindered by portions of fibrine, which form bands
ds stretching across the canal.†
ore commonly happens that the obliteration is perma-
d the vessel is lost to the circulation, the clot (frequently
ed) and the vein ultimately forming a firm, shrunken,
nes calcareous cord. The collateral circulation carries
blood which should have passed through the lost vessel;
, before this is established, and even after, there is
of those parts from whence the return of blood is
d, and occasionally even hæmorrhage. The extent and
of this œdema (*white swelling*) will depend, (*a*) upon
e of the vein obliterated, (*b*) upon the extent of the
tion, and (*c*) upon the sufficiency of the anastomosing
to remedy the obstruction. When the œdema is at-
with considerable pain, a low state of inflammation is
dded. The part is swollen and hard, but does not pit on
e, as in anasarca, and is not red, as in phlegmonous ery-

cellular inflammation, and erysipelas itself almost always occasions an affection of the veins.

This œdema often embarrasses the repair of fractures, m especially when the breakage is near a medullary foramen a involves the laceration of a large vein, or when the tiss around are greatly bruised from the direct violence of th injury, so that clots form in the principal vessels. As th complication is of such common occurrence and of such seri importance, it is strange that attention has been so li directed to it in cases of tardy or non-union. It may be s pected when, about the fourth week after the injury, the pa continue or become œdematous, cold, and often aching. T remedy consists in endeavouring to improve the circula through the superficial veins, which are least often obstruc by friction with the hand and by position. It is, howe always a serious affection, as shown by the frequency w which opportunities offer for inspecting the bodies of old a feeble people who die some weeks after a fracture with no tr of union, but with numerous ecchymoses and plugged ve around the seat of injury.*

It depends upon the quality of the fibrine whether it ca these simple obstructions, or whether it softens and disi grates, forming a thick yellow fluid, sometimes blood-stai which resembles pus (puriform) in its appearance, and whi with the complications it may give rise to (pyæmia), has b already described.† The clot when softened is usually s off (sequestered) in an upward and downward directio newly-added coagula. And here I may observe, that the so ening begins, as a rule, in the coagula last formed, not, Virchow states, in those first deposited. For in the advance the malady the patient's health fails, and the fibrine beco more and more prone to disintegrate and soften into a purif fluid.

The symptoms of obstruction of the deep veins are obsc even when attended with ordinary inflammation of the pa around. There may be some constitutional disturbance; superficial veins may be congested, and after a time the occ rence of œdema may be noted. When the limbs are affect they feel hot and dry, are usually flexed, and cannot be exten

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* See 'Notes on Non-uniting Fractures,' *Med.-Chir. Trans.* vol. li.

† See PYÆMIA, vol. i.

out considerable pain. If the superficial veins are involved,
can be felt as hard cords under the finger, the induration
due to the thickening of the tissues around, to the clots
in, or, more often, to the two conjointly. The course of
ttendant inflammation is marked by redness and tender-
and may be distinguished from inflammation about the
hatics by the small size of the cords in the latter, its super-
character, and the rose-coloured redness of the skin.
diagnosis between affections of the deep veins and of the
rbents is not so clear. An accompanying injury, from
h the mischief may have started, and which is generally
ontusion or an open wound of some kind, will usually
gest to us the probable condition of the neighbouring veins.
n many cases no danger is to be feared; but when large and
ortant veins are extensively affected, as those of the pelvis
lower extremities conjointly, nutrition is so largely hin-
ed that death by no means unfrequently results. The ob-
ctions often cause serious complications, as has been already
ntioned, and there is danger of portions being separated
n the clots in the veins and causing secondary mischief in
capillaries of various organs (pyæmia).

Treatment.—If the nature of this affection is rightly under-
od, the description of its treatment becomes simple enough.
e patient's health must be upheld by doses of bark, or of any
er approved tonic; and a generous diet must minister to his
endment. If there be any error, it will be on the side of not
ing enough in this respect. Locally, rest must be insisted
on, if possible in such a position as shall favour the circu-
ion through the part affected. The circulation should be
omoted in the superficial veins, as has been already indicated,
the surest means of relieving œdema. If there be pain from
inflammation, it may be soothed by warm fomentations; if
be chronic and from œdema, it is useful to give opium in
me form, and thus for the time relieve it. Each case in
hich the symptoms are at all serious will probably require
tient watching; for the disease, with its series of stages, the
agulation, the eventual obliteration and the righting of the
rculation, is of slow progress, and must, after all, be left
retty much to nature. Our anxiety to render assistance should
ever lead us to the employment of such remedies as blisters
applied to the œdematous limb; nor can aught but harm be
anticipated from depletion, the use of mercury, or of such-like

powerful medicine. Except in the case of the complicati to which I have referred, a favourable issue may be anti pated.

SUPPURATIVE PHLEBITIS.

It remains to refer to the so-called *suppurative* (diffuse) p *bitis.* This disease is, in fact, nothing more than a diff phlegmonous inflammation, and ought to be reclassed w disorders of that character, from which it was separated account of a prevalent opinion that the inner membran veins was the part first and chiefly affected. This inflammati follows the course of veins which, acting as conductors, fav its rapid extension in the direction of least resistance; hence, as a rule, the disease passes from the small to larger vessels, since the cellular surroundings of the latter the easier route for its advance. That the parts around first affected, and not the lining of the veins, is shown by examination of fatal cases. There is no preparation of so-call suppurative phlebitis I am acquainted with in which the par around the veins are not inflamed and thickened.

No patients in a fair condition of health could suffer fro this disease. The worst they could be troubled with would a limited (adhesive) inflammation of the parts around th vessels, with attendant obstruction of the veins with clots, But if the system is depressed and enfeebled, as when suffering from extensive ulcers, from large lacerations, or after severe operations, this disease, attacking wounds and adjacent structures, extends along the course of the vessels, just as in othe cases it happens to extend along the subcutaneous cellula tissue, and is known as phlegmonous erysipelas. It arises from various local irritations; in one case, the puncture (venesection), in another, the division of a vein, is its starting point; and it often occurs after amputations, as after other wounds not, however, in consequence of ligatures applied to veins Whether these vessels be tied or not, this inflammation may supervene; indeed in every amputation, as remarked by Blandin,* the veins which accompany small arteries are always tied; and we have no right to argue that the ligature of a large vein is more likely to be followed by diffused inflamma-of its wall, than is that of the smaller vessels. Such an mption cannot be justified.

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* *Journal hebdomadaire*, tome ii. p. 579. Paris, 1829.

hilst remembering that various degrees of severity exist veen the limited (adhesive) inflammation of the tissues und a vein, and the most severe form of diffuse suppura- n of the same structures, we will take a bad case of the latter giving a correct idea of the nature and progress of the ease.

n March 27, 1861, I examined the body of a man who died in St. Bartho- ew's Hospital under the following circumstances. He fell from a height, so upon some iron spikes, which penetrated one into either thigh. Diffused mmation became established along the track of the wounds, more especially the right side. On the fourth day, without material aggravation of the ptoms, the right saphenous vein became indurated along its entire length. lungs became congested, symptoms of dyspnœa were added, and he died phoid) on the seventh day. The right wound extended across the thigh to inner side, and unhealthy pus was diffused far and wide superficial to the cia lata. The tissues around the saphena vein were laden with extravasated od, and with unhealthy sanious pus. The glands, especially about the upper rt of the thigh, were enlarged and blood-stained. The outer coat of the phena was œdematous, the internal surface of the vessel was rough, and the ner coat was, for the most part, wanting. There was no increased vascularity the vessel. Its canal was filled with sanious pus, and occasional shreds of od-clots. Just above the inner ankle it was suddenly contracted, and tained a tapering coagulum; and here was the limit of the surrounding in- mmation. The femoral vein, at its junction with the saphena, was laden with ft coloured clots, which extended into the external iliac. The lungs were ngested and œdematous.

The changes in this and in allied cases may be described as n infiltration of the tissues around each vein with serum and rpuscular lymph. This quickly degenerates, and forms a ries of abscesses, or rather a diffused collection of pus. The apidity with which these results follow each other is most alarming. The veins at first contract, entangling as they do so, some few coagula; but presently such portions dilate. Beyond these, other parts of the same vessel are undergoing, as the surrounding disease advances, the earlier process of contraction; and again, beyond such portions, clots close their canal and mark the momentary limit of the disease. And so it extends, following the vein-course. All branch vessels are closed with clots, or involved otherwise in the disease, so that no blood flows through the vessel, and thus, and from the condition of the parts around, no nourishment can now reach the inner vein-coat; so it dies, becoming cloudy, forming an inorganic friable pulp, which gradually melts down until no trace of it remains. The inner coat being destroyed, pus finds its way the dilated vessels, either direct from the other vein-coats, through them from the parts around; for these coats, depri like the inner of their blood-supply, frequently perish in course of the disease.

The symptoms which accompany these changes are of a even typhoid character, ushered in with rigors, and a gen increase in the severity of pre-existing signs. If superf veins are involved, the accompanying induration and congesti of the parts around will mark the progress of the disease; if deep vessels are implicated, it is upon the accession of gen symptoms, and upon the uneasiness about the parts affect that we must rely for a diagnosis, which indeed is not al easily arrived at. When diffuse suppuration is establi a satisfactory issue is doubtful, although in the less severe ca we may succeed in limiting, and so in arresting the disorder.

To effect this, every effort must be directed to the support the patient with stimulants, nourishing food, and tonics; wa fomentations applied to the parts affected, must be combined, possible, with free incisions to allow of the escape of the healthy material depositing along the course of the vess But enough has been said in treating of erysipelas and pyæmia, to render it unnecessary to enter here into details management, which would be merely a repetition of those commended for the aforesaid diseases.

In cases of diffuse suppuration, the coagula play an unimpor- tant part, very different from that which they occupy in cas of clot-obstruction (more especially when they soften and acquire the puriform condition). Enough has been said to show the great difference between the two affections; but unlike as are the two diseases, they have this in common, that either may be the cause of those secondary complications to which the term pyæmia is properly restricted.

Infants occasionally suffer from inflammation about the umbilical vein, as noticed by Osiander, Meckel, and by Duplay.* It commences from the second to the twelfth day, and is often preceded by some injury which the child has sustained. In other cases, it would seem to depend upon influences same as those causing puerperal fever and allied dis- rs. Duplay found in three out of six cases that erysipelas associated with the affection of the cord; and occasionally local gangrene occurs, thus showing the low phlegmonous racter of the affection. The general bad condition of the ldren is also indicated by discharges from the mucous mem- nes, and by the co-occurrence of purulent ophthalmia. Death urs from the twelfth to the sixteenth day. The entire cord involved, thickened, with the structures around, and often h peritonitis. The umbilical vessels are all obliterated in common affection, their canals being filled with clots, ich have been found to extend into the portal veins. The t of the child and the various secretions require attending and warm fomentations may be applied to the inflamed uctures; but the tender age of the infant is unequal to resist serious a disease, for a fatal result has followed in all recorded es.

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* *Revue médicale*, 1838, tome iii. p. 104. See also Morgagni, *Epist. Anat. Med.* liii. art. 37.

Some veins not infrequently contain loose *calculi* or phlebo- hes, generally round or oval, and sometimes attached by a rrow pedicle to the inner wall. No inconvenience results from eir presence. They are found most frequently in the veins of e pelvis about the bladder and prostate, especially when the tter is enlarged.

Their origin has been much questioned. Bichat[*] thought at they occurred in veins exposed to slow circulation of their ontents. Hasse found them connected with varices. Hodg- on[†] held that they were probably formed in surrounding parts, nd made their way into the veins by absorption. Cruveilhier tated that they were developed in the centre of a clot of blood. t is, however, most probable that they are clots which have hus dried up and become transformed. Having protruded from some small branch, they receive additions to their surface, and, eventually separating from the pedicle which held them to their original vessel, shift their situation, and are perhaps rolled along for some distance by the blood-stream before being finally arrested.

They are formed of concentric layers, which consist, according to an analysis kindly made for me by my friend and colleague Dr. Frankland, of protein matters and phosphate of lime. The former, constituting about twenty per cent. o calculi, are nearly all albuminous or fibrinous; the l though mainly phosphate of lime, is mingled with a sulphate of potash and sulphate of lime. That is t the phlebolithes consist, as might be expected, of the c lated protein constituents and the less soluble salts blood.

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[*] *Anat. gén.*, par Béclard, p. 104.

[†] *Dis. of Arteries*, p. 511.

Hypertrophy and Atrophy.

Hypertrophy of veins occurs when any part of the bod seat of increased growth. It is a natural and healthy c Thus during pregnancy the uterus is provided with e channels for the removal of its venous blood; and thus in of medullary cancer of the omentum I have seen the por twice its natural size, in consequence of the large qua blood carried to it from the rapidly-growing tumour.

With this form of hypertrophy there is proportionate tion, so that the vessels are perfect to perform all their fu They are thus adapted to new conditions, as when an a wounded through a vein, and the latter dilates (aneurisma above and below, its walls becoming thickened so as t the arterial impulse.

Hypertrophy with dilatation also compensates for m structions to the circulation by fitting one set of veins t up for the loss of any other. Thus no inconvenience when superficial veins are obliterated, for by dilatation tomosing branches the circulation is readily re-esta When the vena cava inferior even is permanently clos well known that the lower portion of the vessel dilates mon with the branches opening into it; that various sm become large—for example, the superficial abdominal or major *—and so carry to the heart the blood which o have reached the right auricle by the usual channel. cases have been long on record. One, described by] is preserved at the College of Surgeons, and shows t vein slightly dilated below an obstructing coagulum, a (dilated) set of veins about the groins having carried circulation for several years before death.† This kind tation ceases when the veins can conveniently carry th antity of blood, and the change is permanent or temporary as obstruction remains or is removed, for in the latter case the ns usually regain their ordinary size.

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* Museum, Guy's Hospital, 1521^{32}.

† Museum, 1732. See cases by Morgagni, Portal, Petit, Cline, an also Reynaud, in the *Journal hebdomadaire*, tome ii. Paris, 1829.

The only anatomical change which attends this increase of a n is the addition of transverse fibres to its middle coat; its gth is unaltered, and its walls remain smooth and uniform, e where pouches behind the valves account for slight irregu- rities; but as noticed by Baillie and Watson,* 'the vessels e often bent and twisted when the current forces its way ckward against the opposing but ineffectual barrier of the lves.'

If the obstruction to the circulation is in the heart, or in the ngs, that is to say, in one of the central organs through which l blood must pass, no round-about channels can rearrange the rculation. The veins still dilate, but the change is passive, nd accommodates them to the blood which accumulates within heir canals, because its onward passage is impeded. Thus it appens, with obstruction from disease of one of the valves of he heart, that the entire venous system dilates, so that veins hich can be seen, such as the external jugular, are turgid and istended. Maybe, with this dilatation, there is proportionate trengthening of the vein-wall; but it more commonly happens that the yielding is simply passive, increasing until relieved by rupture of the wall (hæmorrhage), or by exudation of serum (anasarca).

Atrophy of veins, in common with atrophy of other structures, naturally follows disuse of a part. After amputation above the knee, the femoral vein lessens to one-third of its previous size; after removal of a testicle, the corresponding spermatic veins shrink and waste. In a case in which the right kidney had been transformed into a large cyst from the impaction of a calculus in its ureter, the canal of the renal vein would not admit an ordinary-sized probe.

Degeneration of the coats of a vein never associates with atrophy of the vessel; indeed, its rarity under any circumstances offers a marked contrast to its frequent occurrence in arteries. In the museum of St. George's Hospital,† a vein from

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[*] Museum, Middlesex Hospital, series vi. 32^{e}. *Trans. of a Society for the Improvement of Med. and Chir. Knowledge*, vol. i. p. 127.

[†] Series vi. 191.

the broad ligament of the uterus contains a round white m within its tunics, the vein being pervious; in another case, calcareous deposit involves the internal saphena; and Bi mentions a case where a similar deposit was found in the c of the vena cava inferior, near its division into the com iliacs. Béclard observed calcareous degeneration in the fem vein, and Macartney and Andral in the internal saphena. has also been met with in the hepatic veins;† but its occurr may be considered accidental wherever situated. Indeed doubtful if these calcareous plates should be regarded degeneration of the vein-wall; it is more probable that depend upon an after change in some local deposit of fibri

VARICOSE VEINS.

Varicose veins. *Varix.*‡ *Phlebectasis.*—When a vein bec dilated without any good object or purpose, it is said t varicose. In the active or passive dilatations already desc which adapt these vessels to certain states of the circulatio purpose is as evident as is the gain which results. Not so varices. No good comes from them. They are useless hurtful.

Many of the early medical writers were familiar with that is at present known respecting varix. It is still the ' tation of a vein' described by Paulus Ægineta;§ an treatment of the dilated vessel continues practically uncha Some veins, so far as is known, are unaffected by varices, among those which have been reckoned as varicose a con able number ought rather to be referred to that hypert with dilatation which has been already described. Thu tumours formed of tortuous and dilated subcutaneous (fancifully likened by Severinus|| to the head of Medusa), occasionally occupy the hypogastric region, simply compe for the obstruction of some large vessel, such as the vena inferior, unless indeed they are due to that congenital co nication in rare cases maintained between the portal systen

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* Museum, St. Thomas's Hospital, Y, 170.

† Museum, College of Surgeons, 1438.

‡ *Varius*, unequal. Græcis *κιρσὸς* aut *ἰξία* Hippocratis dicitur.

§ 'Varix venæ dilatatio est, aliquando in temporibus, aliquando in una parte, sub umbilico, nonnunquam etiam circa testiculos, sed maxime in cruri *Opus de Re Medicâ*, Lat. don. p. 50. Paris, 1532.

|| M. A. Severinus, *De recond. Abs. Naturâ*, cap. ix. § 13.

aneous vessels of the abdomen by means of a patent um- vein, and of which a few instances are on record.*

varices are commonly met with in the submucous veins bladder and rectum (hæmorrhoids),† in the spermatic (varicocele, cirsocele),‡ and in the veins of the lower ities. They are also, though rarely, met with in the bout the face; more especially those of the lips and eye- In one specimen they may be seen involving the internal ; § in another, the veins of the stomach; ‖ and they are affect the pharynx, œsophagus, and small intestine, but e the records are unsatisfactory. One case of varix at d of the elbow is recorded by Petit; and a boy is stated rren to have suffered from varix which formed between ulder and elbow after violent muscular exertion; ¶ but tasis of the upper extremities is a very rare occur- **

ces of the *lower extremities*, though much had been respecting them, received but little attention from ists. This neglect occasioned and maintained the error r, adopted by most of those who wrote upon the subject, arices are an unnatural permanent dilatation of the *neous* veins, from which the *deep* veins are at first exempt, at the latter, constantly sustained by the muscles, receive hese contractile organs a support by which they escape ion, whilst the subcutaneous, less well supported, can indefinitely.†† The disease, limited in its origin to one vessels, was said to be caused by a retrograde movement blood, or by a mechanical obstacle to the return of the f the heart, or by a communication between the arteries

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veilhier, *Anat. path.* liv. xvi. pl. 6.

DISEASES OF THE RECTUM.

DISEASES OF THE MALE ORGANS OF GENERATION.

seum, St. Thomas's Hospital, Y, 155.

seum, College of Surgeons, 1158.

ité des Maladies chir. tome ii. p. 49; *Surgical Observ. on Tumours*, p. 432.

interesting preparation in the Museum of St. George's Hospital, series shows all the deep veins of the arm varicose. The clusters of veins ling the main artery received an obscure pulsation from it, and there h difficulty in determining the nature of the affection. It was noticed on after striking a violent blow.

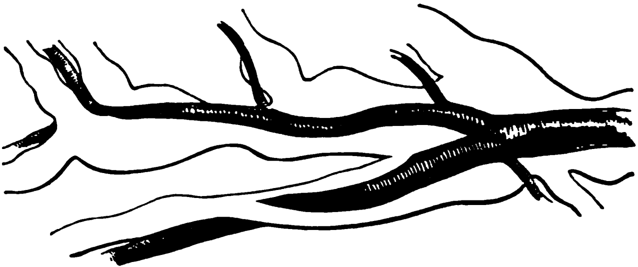
yer, *Traité des Maladies chir.* tome ii. p. 451; Sir Everard Home, *Prac- servations.*

and veins, small vessels passing directly from the one to other. The last suggestion, however attractive in theory, f from the absence of anatomical proof, for the presence of anastomosing vessels has never been shown by dissection.*

The error of Boyer's doctrine rested upon insufficient a mical research; for in fact varices do not invariably comm in the trunk of the saphena, or in that of any superficial v The seat of varices, as shown by Verneuil,† is as often in deep veins, and they thence extend to the subcutaneous ve by the numerous anastomoses existing between the two and far from being rare, the deep varices are of very freq occurrence.

There are various veins in the thickness of a limb: s deeply seated in company with the great arteries, the popli posterior tibial, and the like; some which lie in the subcutane tissue; and lastly, intramuscular veins, which convey bl from the muscles to the deep or superficial vessels, and fo anastomoses between them. These intramuscular veins ca large quantities of blood, and their capacity is great in prop tion. I find that the six principal veins which pass in the ad male from the soleus muscle to the peroneal and posterior tib vessels, have a united diameter of not less than an in Where these vessels open into the deep veins (more especi

FIG. 154.



the peroneal and posterior tibial) the latter are often gre dilated, as may be seen by the accompanying diagram, wh indicates their condition in a case of varix which I examine a body brought to St. Bartholomew's for dissection. Br quoted by Verneuil, found deep varices equally with the su taneous; Denucé observed that they were less rare than osed, and existed even when the subcutaneous veins ffected; Deville and Fouché, their attention being the subject, confirm his statements; and Dumay cates a case in which, whilst tying the peroneal artery, und to be surrounded by large varicose veins with thin walls.

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* Pigeaux, *Traité pratique des Maladies des Vaisseaux*. Paris, 184

† *Gazette médicale*, 1855. *Gazette hebdomadaire*, 1861, p. 428.

ing to Verneuil, the intramuscular veins also become and specimens are preserved in the Musée Dupuytren[*] they are sometimes affected without change in the ous. In my dissections I have failed to meet with muscular varix;[†] but from the examination of bodies for dissection, in which varices are occasionally dis- and in which the vessels have been carefully traced, firm the statement of Briquet, that at the spot where re most common, large trunks communicate through les with the deep veins; and I find the latter as diseased as the superficial vessels, the disease being nced where the intramuscular veins empty their blood r set.

—Certain conditions of system favour the formation of ongenital predisposition amongst others; a disposition y some to be hereditary. Very little is known about ns with an indolent temperament, or persons reduced [‡] suffer from a relaxed and debilitated condition of walls, which lose their tone and their elasticity, and r little resistance to the pressure of the blood. In s, the heart's action is reduced in frequency (I have g adults in whom it beat but forty times in the minute) rce, so that it slowly and with difficulty relieves itself ous blood. Such people, and others to a less extent, likely to suffer from varix if their occupation is one bitually involves much standing or walking—in fact, -continued muscular exertion; and so cooks and s have been selected by Brodie and by Home as prone to the formation of varicose veins. They are l chiefly during the active middle period of life; but earance may be postponed until old age, or may be

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ens 254, 259.

r investigations confirm me in this statement. The various opinions other points in the anatomy of varix are fully discussed in chap. i. s work *On Varicose Disease.* London, 1868.

influence of gout, see Paget, *St. Bartholomew's Hospital Reports,* referred to early life, since they not unfrequently occu children under ten years of age.

Obstruction to the circulation is a passive aid to their fo tion. Hence they coincide with certain diseases of the he of the lungs, with cirrhotic liver, and are common when portal system is overcharged with blood, as with those w *live well*, though such suffer more especially from varices of rectum (hæmorrhoids). Constipation involving the accum tion of fæces in the intestine and pressure upon the iliac ve the obstruction of veins with clots, the pressure of tumo and such artificial pressure as that of an ill-adapted hernia tr or tight garters, may be enumerated as examples of conditi which retard the circulation, distend the veins, and pre them to become varicose.

Such conditions have more influence upon the veins of th leg, because the pressure of the column of blood which the vessels have to resist is increased by gravitation. Although th column of venous blood ascending against its own weight, i supported by the column of arterial blood, yet the pressure o the fluid upon the walls of the veins increases by gravitation, inch by inch, towards the most dependent portions of the body. To illustrate this fact, the small intestine, freed from it mesentery, may be held so that its upper and lower outlets ar upon the same level, the intermediate curve being pendent. I its canal is filled with water, it is easy to compare the lax condition of its walls above with their tension, almost to bursting at the curve below. In the veins this tension is relieved b valves, and some dilatation is permitted, as occasion requires by their thin and yielding walls; but when the occasion passe by, the elastic vessels soon recover their natural capacity, an then the slightest force acting upon the blood-column tends t quicken its movement through the venous system. If ther exist a tendency to dilatation by obstruction, such force, instead of moving the blood-column, is expended upon the vein walls:* and if the force is represented by a certain quantity o blood forced into a vein, then there is added an increased tendency to dilatation by excess of contents.

In persons with relaxed and debilitated veins the varicos condition would seem to be determined by the habitual *ove exercise of muscles*, especially those of the calf of the leg, whic

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* See experiments by Williams, *Principles of Medicine*, 2nd edit. p. 188.

the blood violently into vessels inclined to yield to the
ntion, and already over-filled by reason of a retarded or
ructed circulation. The dilatation which ensues is usually
low progress; indeed, for a time the veins are often in-
sed in thickness and strength to resist this distention; but
records cases, and his observations are confirmed, in which
varices have suddenly appeared after violent muscular
tion,* such as running, dancing, or carrying heavy weights.
vever, so far as superficial varices are concerned, the intra-
ular veins pass into the subcutaneous, there the varix is
noticed; there the force, that is the blood-stream impelled
the muscles, tends to act on the vein-wall and to dilate
essel; for the valves obstruct below, and the column of
ucted slow-moving blood resists above.†

anatomical changes in varicose veins have been described
ndral; and his distinctions, though too minute, have been
ally adopted.‡ In brief, it is sufficient to notice, that the
of the dilated vessels may become thickened, or may
ne thin; that they may be lengthened, so that the veins
ndered tortuous; that the dilatation may be unequal, the
being marked with pouches, which form at the sinus be-
each valve, or result from the greater yielding of the
where the blood is forced into it from an intramuscular
ch; that varix of the femoral vein, which occasionally
res to be distinguished from a femoral hernia,§ is thus
ed by yielding of the vessel at its junction with the in-
l circumflex, saphena, and profunda veins.

Varren, op. cit. See also Malgaigne, *Œuvres compl.* t. ii. p. 268.

r. Gay has elaborately considered the question of the cause of varicosity
p. cit.). So far as I can judge it seems desirable to assign as causes those
ned in the text, especially the influence exercised by the intra-mus-
veins upon the deep and subcutaneous systems of veins in the lower
mities.

arices: species 1. Simple dilatation, affecting the whole length of a
or existing only at intervals. 2. Simple dilatation, with thinning of the
es. 3. Uniform dilatation, with thickening of the parietes. 4. Dilatation
rvals, with thickening at the dilated points; in this, and in the third
s, the vessel being lengthened as well as dilated. 5. Dilatation, with the
tion of septa, which divide the interior of the varix into many compart-
s, in which the blood coagulates. 6. The addition to the last of many
apertures in the walls, allowing the escape of blood, as in erectile
res.— *Pathological Anatomy*, Eng. Trans. vol. ii. p. 4 et seq. Dublin, 1831.

See HERNIA.

As the vein-canal dilates, the valves, unless previously r tured by violent and sudden muscular action, are unequal close the passage; and, being useless, they presently waste are reduced to mere fibrous bands, or disappear altogeth The valves are not destroyed by the backward pressure of column of blood obstructed in its passage to the heart; they are adapted, as is well known, to resist this pressure, they become, when needful, thick and strong, to fit them doing so. But the force represented by the stream of blo advancing from below, and from the intramuscular vei presses upon their rear, and, as they are unable to resist force acting in this direction, flattens their cusps against vein-wall; and there, when the vein, from the combined acti of several causes, has become so large that the valve-cusps unable to meet and close its canal, they shrink and atroph It follows that, in varices, those valves only are thus destroy which lie between the lowest varix and the heart; and, when th are destroyed, that the pressure of the blood-column, whic they helped to resist, weighs more heavily upon the depende and dilated vessels.

The tissues which surround the diseased veins become gradually absorbed in consequence of the continued pressure of the varix, and thus, as noticed by Hodgson,† bones even become indented. So thin, indeed, may the coverings of a varix become, that, with sudden exertion, or from a blow, they rupture, and hæmorrhage ensues. In cases of long standing, however, it is usual to find the neighbouring structures thickened and hard from simple œdema, or from inflammatory exudation, which, by involving the neighbouring lymphatics, causes many of them to be permanently obstructed; so that, what with their obstruction and the obstructed vein-circulation, the whole leg becomes œdematous, and in time accumulates a great superfluity of fibro-cellular tissue, a condition which in severe cases is recognised as the Arabian elephantiasis.‡

Varices of the lower extremity do not affect especially the left limb. The curious error which long prevailed, and gave

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* Museums, Coll. of Surgeons, 1736, and Bartholomew's Hospital, series xiii. 79. Gay is of opinion, 'As a rule, veins that become varicose are destitute of valves; and the cords which have been supposed to testify to their existence in these veins are referable to another source, viz. blood clot.'—Op. cit. p. 105.

† Op. cit. p. 561.

‡ For erectile tumours, and their relations to varices, see NÆVI.

cedence to the left leg, has been completely exposed. tistics obtained by Verneuil, from cases observed at the tel Dieu, show that one limb is diseased just as often as the er. In fact the cases are rare, if they ever occur, in which disorder does not affect both limbs simultaneously, although greater progress in the superficial veins, which is observed one limb, commonly causes the condition of its fellow to be ssed by unnoticed.

Symptoms.—Though varices may exist for a long time, and use little, if any, inconvenience, yet it is more usual for those o suffer from them to complain, some time before the ternal manifestation of the disease, of aching pain, deep ated in the limbs, with sense of weight, fulness, and fatigue, some cases complicated with a certain numbness and even ss of power in the extremities. In a more advanced stage of e disease, the ankles swell after a hard day's work, and the et are constantly cold. These symptoms indicate an embarrassed state of the circulation, to which is gradually added ilatation of the deep-seated veins, and more especially of the osterior tibial.

After a time, at one or more points in the leg, a small tumour, n an early stage resembling the 'venosité' of Briquet, is ormed, soft, of a bluish colour, from the dark blood showing hrough the integument; it disappears on pressure, but returns when the pressure is removed, or when the patient stands up, and is caused by a vein which is dilating where joined by an intramuscular branch. Around this tumour a series of minute vessels are clustered of a dark, bluish colour—the small superficial veins through which the passage of the blood is retarded to a greater degree than elsewhere, because they open directly into that part of the vessel which is dilating. By degrees the dilatation extends and involves an increasing length of vein, and then forms irregular, knotty, convoluted tumours, soft and diminished in size by the horizontal posture, giving a bluish tint to the skin, which is stretched and thin, and surrounded by smaller veins, also somewhat varicose. These tumours are grouped around the points at which the dilatation first commenced, for the most part in the middle of the leg along the track of the external and internal saphena veins, but the clusters of tortuous vessels often extend along the entire length of the leg and thigh. To the symptoms already enumerated there is often added an unpleasant itching; and when nerve-fibrils are by chance involved, a sharp tingling pain.

Occasionally, when the varices gradually thin the skin which covers them, and burst through it, hæmorrhage ensues, which may cause syncope and even death if not promptly arrested; for the valves being destroyed between the varix and the heart, the escape of blood is directly from the proximal portion of the vessel, and may be very considerable. In treating such a bleeding the patient should be promptly laid on the ground, and the leg should be raised, when the hæmorrhage will probably cease. If it continue, the pressure of a pad of lint applied to the bleeding vessel, and secured by a few turns of a bandage, will effectually arrest it.

In inflammation of the tissues around the veins we have the prelude to irritable conditions of the skin and eczema, to destruction of the absorbents, and to ulceration;* and when the vein-walls from the same cause become surrounded with lymph, the condition is reached in which, as previously described, the vessels become filled with clots and obstructed. The knotty tumours are then hard and cannot be emptied by pressure, and this consolidation is permanent, for varicose veins once obstructed with clots never have their canals reopened. In this way the natural cure of a varicose cluster is often effected, with much temporary relief to the patient: as, however, the predisposition continues, and the exciting cause remains, other adjacent veins soon become involved, and perpetuate the disease.†

Treatment.—Varices of long standing are inveterate; for although much may be done for their relief, they cannot be cured; and hence it is fortunate, although they occasion the patient much hurt and inconvenience, that they are not serious in their consequences. In their earlier stages they are more manageable; and it is much to be regretted that early symptoms are mostly unheeded, for whilst the disease is limited to the deep veins, or at most has involved but slightly the superficial vessels, it admits very readily of permanent benefit.

The management of the general health is an important item in the treatment of varices in every stage. The feeble and often ill-nourished patients who suffer from this disease, must be ingorated by tonics and a generous diet. The plethoric patient, th an embarrassed portal circulation, will gain much from ten-repeated but small doses of purgative medicine, and by e use of cold saline baths. In each case some special sympms will probably demand attention, and must be met by propriate remedies; but in the large class of cases in which ere exists a constitutional or acquired laxity of the veins, no medy equals the tincture of the perchloride of iron, with an erient pill every other night to obviate the occurrence of conipation. Under its influence, combined with proper local pliances, the laxity of the veins disappears, and the varices, if cent, are disposed of.

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* For varicose ulcers, see vol. i. p. 199.

† See cases by Hodgson, op. cit. p. 561.

Provided always that the disease is not of long standing, and that local causes of obstruction, such as tight garters, are done way with, it is advisable, with this general treatment, that the egs should be rested in the horizontal position for at least a month or six weeks. Walking should be prohibited, and only carriage exercise allowed. The limbs, thus rested, should be bandaged from the toes to above the knee, the pressure being firm and equal, and the bandage (Domett) should be renewed daily. At the time of each renewal the limb should be well rubbed with the hand for about a quarter of an hour; by this treatment the circulation through the subcutaneous veins is rendered brisk, and the tonicity of the walls by degrees re-established. What with the inaction of the muscles, the improved tone of the superficial vessels, and the amendment of the general health, a good result may be anticipated.

But patients seldom have the inclination or the opportunity for submitting to such rigid treatment for the cure of a disease which causes comparatively little inconvenience; and when this is the case simple compression of the distended veins will often give great relief, and even prevent the disease from growing worse. Sufficient support may be obtained by merely bandaging the limb, greater pressure being made over the larger of the varicose clusters than elsewhere by means of a pad of lint placed upon each of them before the bandage is applied.* Elastic spiral bandages, or the elastic web stockings, are recommended as conveniently supplying the necessary support. They should be removed at night when the patient goes to bed, and replaced when he gets up in the morning. If any one of them causes irritation of the skin, it must be changed for some other; and it will often be found useful to protect the integument by means of flannel bandage or cotton wool before these appliances are put on. The most difficult to manage are the old varices surrounded by a quantity of indurated tissue, which protects them from ordinary pressure; the difficulty may generally be overcome by the exercise of a little ingenuity in applying the supports. Travers cured a varicose cyst of the saphena by the pressure of strips of plaster. The varix should be emptied of its blood, and the strips, of a convenient length and breadth, should be then applied, crossing one another at right angles. A firm and even pressure may also be obtained by applying a wet bandage. A number of pieces of muslin, linen, or calico are prepared, each about two inches wide and twelve inches long, and saturated with water. Two of these strips are first placed beneath the foot, and their ends crossed over the instep towards the ankle. Other strips are then bound round the leg, their ends crossing in front, so arranged that the one above half-covers the one below, until the limb has been bandaged to a sufficient height. An ordinary roller is then placed over all, and each day the application is renewed.

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* Local compression was first recommended by Delpech and Sanson. See Delpech, *Maladies chir*, tome iii.

These measures are, however, simply palliative; and in the desire to effect the cure of so common, and often troublesome a disease, many devices have, from time to time, been employed. With the exception of Herapath's suggestion for dividing the fascia lata at the saphenous opening to relieve a supposed pressure upon the femoral vein, they all aim at procuring obliteration of the varix, or of the chief vein connected with it. But from all these measures it is quite certain that only a temporary benefit is obtained; for after one mass of varices has been removed, the anastomosing veins around soon acquire a varicose condition, and the disease is perpetuated. In deciding upon performing any one of the many operations open to choose from, it must be the relief, not the cure, of the varix which is anticipated; and no doubt there are cases, yet not so many as some would have us to believe, in which the pain of the varix, the impossibility of healing a large ulcer, the unfitting of a patient for his every-day work, justify the operation for the sake of the temporary benefit.

It has been objected to these operations, that they have sometimes imperilled the patient's life, and at one time they into disrepute by the occurrence of several deaths from inflammation extending along the course of the vein ad been operated upon; but the objection should be ot to the operation, but to the performance of it upon in a bad state of health, who, to avail oneself of the anguage of Dionis, are opprest with humours always cast themselves upon any one locality.* If the cases cted with care, the judgment which decides in favour of ation will never be reproached by the occurrence of hurt to the patient; and the only troublesome conse- will be a languid condition of the wounds, which, from lent circulation through the limb, are, as stated by Skey, ry difficult to heal.

perations recommended for the local relief of varices are ations of one another. Their practice dates from the record of surgery, and some curious peculiarities of nt may be referred to as showing the uncertain reason- ch regulated it. Thus, Celsus drew a distinction between and convoluted varices; for the first he recommends† y should be exposed by cutting through the skin, and stroyed by the actual cautery; whilst the latter he at t out with the knife. Ambroise Paré and Petit ‡ punc- em, squeezed out their contents, and then applied a ss; but when the blood stagnated in an isolated tumour, t down upon and removed it. But, says Paré, old varices be left alone, lest, being removed, the patient should be ed. Boyer followed Paré, but tied the vein above and efore opening it; and Home, after dividing the skin, a thread under the vein, and so tied the vessel leading e varix towards the heart, under the impression that the s it could no longer flow through the vessel, would e, and then coagulate: and in practice Home found that ulcers were thus more readily healed. From what has ere said respecting the causes of varicose veins, it is that no good could follow this operation; indeed, any that patients obtained from its performance was probably the rest which it necessitated.

ngst other suggestions, Fricke advised that two or three

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ochymes et accablés d'humeurs, toujours prêtes à se jeter sur quelque

Re Medicâ, lib. vii. cap. xxxi.

ité des Maladies chirurgicales, tome ii. p. 64.

threads should be passed through the vein, after the fashi
a seton; and Capaletti[*] employed galvano-puncture to i
clotting of the blood within the varix; whilst Graefe[†] ac
opened the vessels and filled their canals with lint. B
these methods were employed without any fixed idea of
was to be accomplished by their means.

Our object is now more definite, as we seek to relieve
time this varicose condition by causing coagulation of the
within the dilated veins, which then shrink and contrac
manently. This result can be attained, 1st, by the act
caustics applied over the course of the vessel; 2nd, by
cutaneous division of its walls; 3rd, by compressing it bet
steel pin and a twisted suture, or by some similar contri
The potassa fusa, or Vienna paste,[‡] may be applied as
mended by Mayo, in quantity sufficient to cause slough
the skin over a varix, or the venous trunk connected w
The tissues beneath the slough inflame, the vessel is fille
coagula, and so becomes obliterated. The slough shou
exceed a quarter of an inch in its diameter, and the surro
skin should be protected from the action of the causti
ring of plaster encircling the portion to be destroyed.
recommends that sufficient caustic shall be employed to
sloughing of the vein, as a more certain mode of securi
destruction, the vessel becoming closed and contracted
and below the slough. According to circumstances,
more of these sloughs will be required, and in making the
must be carefully kept some distance asunder. Wheth
varix is thus itself destroyed, or the venous track which
from it, the blood which formerly passed through these
is driven into other channels, which gradually dilate into
crop of varices.

Subcutaneous division of varicose veins is easily perfor
means of a narrow pointed bistoury, first employed by Br
which is introduced between the skin and the vein, and is
to divide the latter as it is withdrawn. A compress of lint

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[*] See *Archives générales*, 1848, p. 228.

[†] C. Bell's *Surgery*, German Trans., preface.

[‡] Composed of five parts of quick-lime and four of caustic potash,
into a paste with spirits of wine immediately before its application.
acid may be substituted when it is only required to excite inflammatio
the vein.

[§] *Lectures on Pathology and Surgery*, p. 185.

at once applied to restrain hæmorrhage. This operation has e advantage of leaving a wound which heals readily, often by e first intention; but in some cases suppuration has followed, d in some it has failed to obliterate the vessel; so that, says rodie, 'it really appears it is not worth patients' while to subit to it. I have always observed, that if I cured one cluster, ro smaller ones appeared, one on each side; and that ultimately left the patient no better than I found him.' If this operaon is performed to facilitate the healing of a varicose ulcer, the essel should be divided, if possible, below, so as to interrupt he blood as it streams in from anastomosing vessels and causes he distention of the veins about the ulcer. After this or any imilar operation, the patient must be kept quiet in bed for at east four or five days, and longer if necessary.

Velpeau, following Davat, employed a metal pin, which he assed under (never through*) the vein, and on which he applied a twisted suture. The pin was allowed to remain in until sufficient inflammation had been excited to promote obliteration of he vein; but when the irritation which followed was but slight, he pin was left to come away by ulceration of the structures hich covered it. Some of these pins he applied to the varicose usters, and some to the veins communicating with them; and no very bad results followed his operation, it was pretty genelly tested. But, like others, it affords only temporary relief; nd besides is open to the objection that the sores which result re often difficult to heal, although this is an objection more specially to the treatment by caustics. To prevent sloughing f the integument, it is recommended by some surgeons to proect it from the twisted thread by means of a piece of wax bougie. Various other devices for conveniently securing the obliteration, have from time to time been suggested.† A good and expeditious plan is that recommended by H. Lee, by whom it is thus described: 'A needle is introduced beneath the vein or veins to be obliterated, and an 8-ligature is passed over its extremities. The vein or cluster of veins is thus included between the needle, which is below it, and the ligature, which is over the skin. The ligature is then tied so as to produce a slight degree of pressure on the vein, and by this means cavity is temporarily closed by acupressure. Another needle then passed under the vein at about an inch distance, and vessel is there closed in like manner. The vein or cluster veins thus included between the two needles is entirely separated from the rest of the circulating system, and may then divided or otherwise obliterated without risk. Subcutaneous section of the vein is generally all that is necessary, and i preferable to any other mode of operating, as it effectually obliterates the vessels without leaving any open wound. At the expiration of about four days, when union is established the divided parts, the needles are removed, having served th temporary purpose.'

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* Transfixing the vein and passing a thread through it, as proposed by Fricke, was found to occasion such great irritation that its use was presently abandoned.

† Metal pins for compressing veins are described in the *Medical Times and Gazette*, vol. ii. 1861, p. 377.

Except in cases which have been referred to, these operati are not to be recommended; and the patient, if wise, will content with the palliative measures of a more simple charact

I have several times referred to tumours as causing obstruction to the circulation of the blood through veins. Little inconvenience follows, in consequence of the ready formation of collateral circulation. Some tumours compress veins against resisting substance, as bone; some by their growth completely surround them; whilst others extend into their canals, as wa first pointed out by Langstaff in a case of medullary cancer. In many instances they cause obliteration of the vessel by interruption of its canal and by absorption of its coats, or they induce the formation of clots, by which it becomes permanently obstructed. Now and then a tumour appears to have its origin in and to be confined to a vein, as happened in the splenic, as recorded by Hodgson, and in a case, related by Andral,* where the growth consisted of adipose tissue in the wall of a portal vein.†

A few words will dispose of the subject of worms and other ites which were formerly supposed to infest veins. The exact and minute examinations of the present day have d in this matter to confirm many of the statements of the Parasitic animals, except in the cases of migration of the yo of tænia, and in the instances quoted below, are rarely l in these vessels.*

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* Op. cit. vol. ii. p. 423.

† The following specimens give a good general idea of these vein obliterations. Middlesex, series vi. 32, 35: vena cava obliterated by pressure from an aneurism. St. Thomas's, Y, 171: vein filled with encephaloid deposit. Guy's, 1521^{65}: vena cava obliterated by the side of a dried-up hepatic abscess; and 1521^{90}, by pressure from enlarged glands. Guy's, $1522^{7\ 15\ 25}$: growths of cancer into superior venæ cavæ. St. Bartholomew's, 13, 29: fleshy growth between vena cava and kidney, obliterating the former. Aneurisms and abscesses, though they sometimes burst into adjacent veins, may also cause obliteration: St. Bartholomew's, 13, 84; St. Thomas's, Y, 154; St. George's, vi. 128.

G. W. CALLENDER.

Andral, Duval, Treutler, Fabricius, and Rudolphi, Virchow, and Leuckart, e referred to. I find mentioned by one or other of these, echinococcus riens and distoma hepaticum in the hepatic veins; acephalocysts in the ary veins; strongylus and filaria in the veins of a horse; and entozoa ing to the class nematoidea of Rudolphi in the right ventricle of a a. Hæmatozoa, as they are termed, are said to be found in the veins of reptiles, and fish, having perforated the vessels, as it is assumed, in their ings, and being then washed along the blood-stream until they stick in pillaries. Leuckart, quoted by Küchenmeister (Syd. Trans. vol. i. p. 50), es to have met on four occasions with the embryo of tænia migrating gh the main branches of the vena porta. See also Siebold, Syd. Trans.

e remarkable discoveries of Bilharz, Griesinger, Lautner, and others ting the presence of small flukes (Bilharzia hæmatobia, Cobbold) should ferred to. They have been found in the portal system and in the veins of mesentery and bladder. It is stated that in 363 autopsies 'Greisinger d this entozoon present no less than 117 times.' In advanced cases of the se, as it occurs in Egypt and at the Cape of Good Hope, severe diarrhœa and aturia precede death. Dr. Cobbold is so good as to inform me that he has overed the same parasite in the portal blood of the Cercopithecus fuliginosus. reader is referred for further details to Dr. T. Harley's paper in *Med.-Chir.* ns. vol. xlvii.; or to Dr. Cobbold's treatise on *Entozoa*, p. 197 et seq.

DISEASES OF ARTERIES.

Arteritis.

THIS is a rare disease. The most distinct instance
limited arterial inflammation is that of the umbi
arteries, which after the ligature of the funis are some
filled with pus.

Inflammation of the aorta appears to have occurred i
practice of some physicians, and to have been traceable t
influence of cold. One such instance mentioned to me b
colleague, Dr. Goodfellow, followed upon a young man's
for a long time upon his chest on wet ground. But the
formerly described by surgeons as primary inflammati
arteries appear, by the light of later research, to have bee
to the previous impaction of a plug. Inflammation of an a
and even suppuration, may then take place, but it is a seco
disease, and it will be referred to in the section on 'Occl
of Arteries.' Upon the cases in which long portions of
are found obliterated and converted into fibrous cords, it
suffice to say that no evidence of previous arteritis or o
cause whatever can be adduced, and that the same result
out obvious inflammation attends the obliteration of the d
arteriosus, and sometimes follows the application of a liga

The diseases of arteries besides inflammation are few,
they are but in part distinguishable by the anatomical div
of the coats. The outer coat may be involved in diseas
the sheath and of the intervening connective tissue, but, th
yielding to scirrhus, and being sometimes perforated by it,
coat long resists the encroachment of medullary cancer, w
may grow around it and form a tunnel for the vessel. A
growth, described by Dr. Moxon under the name of Per
geioma, is a rare instance of disease limited to the outer
and sheath of arteries. It formed a tumour of the s
permeated by enlarged and tortuous vessels, and made up

aterial occupying uniformly their outermost and circum-lar structures.*

eases of the middle coat are probably only secondary to of the lining and external tunics of the vessel. The great rophy of that coat, pointed out by Dr. G. Johnson, in the ter vessels in cases of Bright's disease, or its dilatation in hthalmic bronchocele, do not engage the special attention surgeon.

e most common disease of arteries is that of the inner coat, it is of much importance in practical surgery, from its in weakening, enlarging, and occluding arteries.

ATHEROMA.

the earliest stage of atheroma a thin, soft, and clear mem- e lines a part or the whole of an arterial tube. It is at first ly distinguishable from the natural inner coat of the l; its free surface has the shining smoothness of that brane, and as it acquires firmness and a closer union with original internal coat, it furnishes, in fact, a new lining to artery. This structure is added to the artery without the htest appearance of disease in the original textures of the el. Its coats are neither infiltered nor inflamed. There g no manifest cause in the artery itself for the formation of new membrane, it may be looked upon as probably deposited m the interior of the vessel from the blood.

This opinion as to its source is confirmed by the fact that the er coats of an artery are devoid of nutrient blood-vessels, om which the new layer could be secreted, and by observing s further progress. On the inner surface of the new deposit stratum similar to the first is laid, and, like it, becomes onsolidated, firmly adherent, and in its turn the foundation of dditional depositions. When many of these strata have thus ccumulated within the vessel, the whole mass is no longer ransparent, but becomes opaque, dull, and condensed into a material similar to hardened albumen, and eventually to ligament. The layer last deposited may still be often detected, thin, smooth, soft, translucent, overlapping the edge of the deeper mass, and possessing, both in appearance and on microscopic examination, the characters of a lining membrane.

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* 'Periangeioma of Scalp; excision; recovery.' By Mr. Thomas Bryant. *Trans. of Path. Soc.* vol. xix. p. 376.

The coats of the artery are at first unchanged; but as the deposit accumulates their function is abolished; they waste, and lose their firmness, elasticity, and natural colour. The fibrous coat turns to a dull yellow hue and softens, and it may be easily stripped off. With its natural texture, it loses its contractile power; it dilates, and is unequally thinned out, spaces being formed between its fibres, through which the deposit comes into contact and adhesion with the cellular coat of the vessel. The outer membrane at first becomes unnaturally vascular, swollen with infiltration, and manifestly inflamed. As the activity of this process subsides, it is converted into a callous, white membrane, closely adherent to the deposit and to the remnant of the middle coat.

One of two changes may occur in such an indurated lining plate of an artery. It may soften in its interior, or be converted into a layer of cretaceous matter.

Both the softening and the change into bone take place in the deeper parts of the deposit. In the former process it degenerates into a thick pulpy mass of cholesterine, oil-globules, and albuminous and cretaceous molecules. The inner strata separate this pulp for a time from the blood; but when they give way, the whole is gradually washed out into the stream, and the base of the cavity, composed of the weakened walls of the artery, is exposed to the impulse of the blood. The possible occurrence of an aneurism, particularly a dissecting aneurism, in this condition of the vessel will be evident.

Cretefaction, or ossification, likewise occurs only in a thick deposit, and in its external, oldest layers. The inner surface of a bony plate of an artery is for some time lined by the most recently laid stratum of membrane; but if at length this also ossifies, the plate is exposed in the vessel. Externally, nothing intervenes between the plate and the middle coat, for the original lining membrane partakes in the chalky degeneration. The bony growth varies in its form in different specimens, and still more in different arteries. In the aorta, the innominata, and the common iliac, it assumes that of plates of different sizes, irregular in outline, generally concave and smooth internally, rugged and convex externally; whilst in smaller arteries it grows in the shape of rings, which answer in their position and direction to the yellow circular fibres, and have been regarded as ossifications of that coat. In some of the la arteries, a rough mass of bone may even project into the ca

h of so peculiar an aspect as to be compared by Pro-
okitansky to stalactite.

xtent to which atheroma affects the system of blood-
is very various. In some instances, every artery suffi-
large to be named by anatomists is thus diseased; in
certain vessels or parts of vessels are unaffected by it.
ve atheroma of the aorta is almost invariably attended
se of the other arteries; or, to state the same fact in
in which it is usually presented to the surgeon, if the
f the limbs are found diseased, it may be presumed that
ithin the trunk are in a similar condition. It is neces-
note the instances in which the disease is limited.

aorta may be diseased throughout, yet the coronary
may be healthy; and it is interesting to contrast the
ourished state of the heart in such a case with its con-
vhen its nutrient arteries are diseased. The aortic
he commencement or the whole of the arch, may be
atous, and no other vessel be affected. Isolated patches
isease may occur between long tracts of healthy artery,
of the greatest importance in surgery to know this fact
on to the popliteal and axillary arteries, of which short
may be even ossified, while the femoral and subclavian,
concerns the possibility of their being successfully tied,
thy. When at all advanced, the disease is found to be
ical; the arteries of opposite limbs being equally and
affected. This fact is well illustrated in the not un-
occurrence of parallel, almost contemporaneous, popli-
urisms in the same person. Some vessels are earlier, if
re frequently, affected with the disease than others.
such a preponderance in the lower extremity over the
oth in the proneness of its vessels to the disease, and in
ree which atheroma attains in the more distant limb.
tire arteries rarely become atheromatous. Those of
ach, liver, and intestines, are remarkably exempt from
ction, even though it may have attained an advanced
the splenic and the other arteries of the body. As a
rule, atheroma is a disease of the arterial trunks and
ranches, but it is occasionally met with in very small
On one occasion, when making horizontal sections in
ary mode of examining a brain, I found all the minute
scending through the central white matter of the
converted into stiff wires of bone, the first incision of

which blunted the knife. Haller once met with atheroma i
hypogastric artery, but it is the only case on record
most marked exemption, however, is that of the venous sy
including the pulmonary artery and its branches; and
a very suggestive fact in reference to the causation
whole disease. Atheroma, even its early stage, is rarely
in the vessels which carry venous blood; and when it does
it is associated with extensive disease in the aortic syste

So marked a difference in the liability of the two syst
vessels to this disease might seem to point to their struc
its cause, and lead to the error of regarding it as an affe
the middle coat of the arteries. But that a mere differ
structure cannot account for the exemption of the venous
is evident from the facts, that the contrast between
systems is continued into the heart itself, that the de
cases of arterio-venous aneurism is at least as abundan
vein as in the artery, and that it is readily formed wi
pulmonary arteries, when a preternatural communica
mits arterial blood from the left to the right side of th
It appears clear therefore that the source of the morbid
is arterial blood. It is further observed, that the dise
vails chiefly in persons who are in the decline of life
associated with a defective nutrition of the normal struc
the body, with arcus senilis, and with an accumulation

An attempt has been made to connect it with the inordinate use
and there can be no question of its frequent, if not invariable, occ
drunkards. There must exist, however, some more hidden fault in
tion or purification of the blood, to which, rather than even to a
disease must be attributed. Young found calcareous concretions in
of an infant; Wilson in a young child; and Andral in the aorta of
eight years of age. The latter author also met with ossific laminæ i
in five or six persons of from eighteen to twenty-four years of a
extensive ossification of the superior mesenteric artery of a person
thirty.* Corfe records an instance of fatal aneurism, as arising
disease, at the age of twenty-eight; † and in the Hunterian Museum,
is a specimen of it in no alcohol-drinker, but in a jaguar. The gouty,
the rheumatic, the persons whose tissues are imbued with fat, and th
excretory organs fail to purify the circulating blood, are far more pr
disease than the phthisical, the cancerous, or the young. Soldiers ap
more than usually prone to atheroma, and consequently to aneuri
arterial deposit is in them rather compact and leathery, and does not
into the stages of softening or of ulceration. This form of disease is
to be one of the products of syphilis, which is apparently more than
source of blood disease in these otherwise healthy men.

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* Copland, *Dict. Med.* vol. i. p. 119. † *Physiognomy of Dise*

e microscopic examination of the white and buff-coloured sits shows them to be chiefly composed of granules and lobules. Mr. Gulliver first described them as containing esterine, oleine, and often some margarine.* Chemical stigations of the bony plates, by Dr. Bostock, proved them ontain 'a minute trace of albumen and gelatine, animal ter, much phosphate of lime, a little carbonate, and a trace ulphate.'†

he atheromatous change in an artery is slow in its pro- ss, and can only when far advanced be detected in the living ject. It is occasionally attended with persistent pain, which able to be mistaken for a rheumatic pain. When actually fied, an artery which can be felt at all may be readily dis- guished as thus diseased. In the radial, for instance, rings chalky matter can be recognised as the finger is moved ng the vessel. But attention is often first called to the te of the arteries rather by some secondary symptom of ir disease than by the atheroma itself.

1. Atheroma is at first attended with a narrowing of the ibre of the vessel, in proportion to the thickness in which it leposited. This is most marked at the bifurcation of trunks, d at the mouths of small vessels passing off from large trunks. no spot is it more commonly observed than at the origins of e intercostal and similar arteries, which branch off at right gles from the aorta, and which are sometimes not only rrowed, but at last completely closed, by the accumulated posit. Though the larger arteries are perhaps never ob- erated by this process, yet even they may be much contracted it. The canal of so large a vessel as the common iliac has en found diminished by one-half,‡ and the great ascending anches of the arch of the aorta nearly obliterated.

Of the latter occurrence, Dr. Yelloly recorded an instance. A man, aged ty-six, who was supposed to be in health, but who had suddenly fainted two three times in the two years preceding his death, fell and died while at work his garden. The arch of the aorta was dilated and atheromatous, and the ree great vessels ascending from its arch were in a considerable degree plugged p with a growth similar to the lining membrane of the artery, and without any ony deposit.§

A diminution of the size of branch-vessels from this cause

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[*] *Med.-Chir. Trans.* vol. xxvi. p. 90.

[†] Ibid. vol. xix. p. 87.

[‡] Hunterian Museum, 1614.

[§] *Med.-Chir. Trans.* vol. xii. p. 576.

may prove to be of serious importance in some cases,
dering the establishment of a collateral circulation.

2. A later consequence of the disease is dilatation
vessel. The outer coats being incapable of compressi
deposit, and closing in upon the blood after each cardi
tole, they fail to contract during the diastole, and the
gradually expands. This enlargement is the most mar
those parts of the vessels through which the current of th
is in any degree obstructed. All curved arteries, th
are disproportionately dilated. It is observed also in al
at which an arterial trunk naturally widens in its cour
suffers in consequence a more forcible internal hy
pressure than the smaller tube which leads to it. The
extremity of the common carotid is thus widened nat
and dilated when atheromatous. In that situation, at th
end of the innominata, and in the higher part of the f
artery, the expanded vessel may claim attention as an an

3. The same mechanism which converts an artery
fixed tube, incapable of contraction, but liable to dila
produces a similar effect upon its power of retractio
healthy artery is in a state of longitudinal tension. I
it were, too short for the limb to which it belongs; and,
across, may shorten an inch or more.* Atheromatou
bony plates destroy this retractile power. But though
pable of shortening itself, the vessel may be lengthened
repeated injections of blood along it. Arteries, therefo
which atheroma has reached an advanced degree, becom
only dilated, but also tortuous. The outline of brachial ar
thus affected may be seen in the bare arm, every pulsati
the heart increasing their curvatures. The common an
ternal iliac arteries, too, bend far from their normal posi
the former arching outward and forward between the aorta
external iliac, the latter leaving its place upon the psoas,
curving deeply into the pelvis in a new course.

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* An artery *may* shorten to this extent. I have observed the ends of
brachial artery, in a boy of thirteen, to have separated more than an inch
a half when the elbow was extended. On the other hand, a cleanly
healthy common femoral artery, preserved, with the adjacent structures
Hunterian Museum (No. 1568), has neither retracted nor contracted
wound is stated to have caused fatal hæmorrhage. It may be remark
explanation, that the brachial artery is very loosely connected with its
and is not fixed by branches; while the common femoral is a short
and rather intimately adherent to its sheath.

n ossified artery does not retain that smoothness of its
r which characterised the earlier deposition within it.
rge vessel like the aorta, a bony plate may crack across,
lifted at its edge from the wall of the vessel; and the
rough projection thus exposed may cause the adhesion
ine. Strings and masses of this substance, as it ac-
ates, materially lessen the calibre of the vessel, or, being
n off, and carried along with the stream of blood, plug
naller artery in which they happen to be arrested. The
ation of smaller trunks, as the femoral arteries, produces
other manner a roughness of their canal. The bony
r being thickest, or sometimes only existing in circular
the vessel is strongest at those parts, while it yields
en them. The interior of such a vessel is consequently
nger smooth, but is formed of a succession of alternate
verse ridges and bays; the former answering to the rings
ne, and the latter to the expanded spaces between them.
an artery resembles the interior of a piece of jejunum,
the canal of which folds of the valvulæ conniventes project;
he effect of the arrangement, just as in the bowel, must
retard the current.

It has been already mentioned, that an atheromatous
y becomes dilated, and that it may yield and become
rismal at a part from which the softened deposit on its
ior has been washed away. It may be added, that the so-
d ulcers of arteries, which are occasioned by the partial
chment or the cracking of calcareous deposits, ‘are some-
s so deep as to reach, and even to perforate, the external
llular tunic.’*

t, even without such previous detachment of its inner portion, a diseased
y may be torn through by the direct force of the blood. Dr. J. Risdon Ben-
has recorded a case of sudden death, in which the aorta gave way before
npulse of a hypertrophied heart. The ‘rupture was directly through all
oats of the artery; the edges of the aperture were somewhat ragged, and
rsed a patch of atheroma.’† Messrs. James and Rose have published
ar cases of spontaneous rupture of the aorta, and Mr. Arnott one of rupture
diseased aorta from violence.‡

t is obvious that these accidents are the more liable to
ur, as the disease is limited in extent. The artery yields at
one weak point.

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* Hope, *Cycl. of Pract. Med.* vol. i. p. 145.

† *Med.-Chir. Trans.* vol. xxxii. p. 161.

‡ *London Med. and Phys. Journal*, vol. lviii. pp. 15, 19, and xviii.

6. In relation to accidents, and surgical operations o ries, atheroma assumes a serious importance. No longe mobile, elastic, these vessels become rigid, brittle, an A direct blow may crack or crush them; a severe wr sudden unusual movement of a limb, may half break the violence which dislocates a bone may tear them and give rise to a vast escape of blood. Mr. Syme alle he has known an axillary aneurism follow such acciden repeated sudden shock of a machine against the elbo quick unguarded movement in lifting the arm to the the purpose of holding on the hat in a breeze.

When a ligature is tied upon an ossified artery, the s conveyed by crushing the bony tube betrays its c Sometimes the artery gives way. In the stump of a amputated, I have seen an ossified tibial artery bre times under the ligature. The vessel was only secure by including a large quantity of the adjacent soft part noose with it. In another case the ligature was woun times round the artery. The difficulty experienced i tying such a vessel, has suggested the plan of dissecti the artery, and placing the ligature on it higher up. uncertain whether such an artery would be better ad bear a ligature in any higher part of its course, the sa seems to be that of securing it in the face of the stum a case would be better treated by the ligature than by sure, but would be unfitted for torsion.

To atheroma and ossification are doubtless due the of the failures of operations for aneurism. Notoriousl the case with the old operation, in which the artery near the mouth of the aneurismal sac. And many ti when the Hunterian operation has been adopted, the r been disastrous from the same cause. The process cannot be perfected in a tied artery, when the lining m is tough, or osseous, or in a state of fatty degenerati the middle coat is wasted, and the outer callous and att and when the rigid tube is incapable of contracting bet ligature and the next branch. From such an artery the separates, perhaps earlier than from a healthy one, and rhage pours freely and fatally from one or both of its extremities. A prudent surgeon forbears from operatin a case, or from tightening the ligature if he unexpect counter a diseased vessel.

Gangrene may occur at different stages, and from various
nstances, in the course of atheroma; but, in itself, that
e is not capable of producing gangrene. For, so long as
ssels remain open, even though rigid, they allow blood to
And, in fact, any obstruction which may be occasioned by
oughness, is, to some extent, compensated for by the dila-
n of their canal, and the distal parts obtain their nourish-
t. But should any unusual and considerable demand upon
irculation be made by a local injury or inflammation, the
lation will prove insufficient; and, as trees with tangled
s sometimes perish in a night upon a sudden increase in the
lity of the flowing of the sap, the distal parts will die. Gan-
e is often extensive when an ossified arterial trunk becomes
ded; and the explanation of the fact appears obvious. The
teral channels, through which alone the blood can reach
remoter parts, are themselves indurated or ossified, and are
pable of adapting their calibre to the larger stream which
ses through them. The unnourished structures necessarily

These occlusions of arterial trunks are not such as are
y slowly completed by the accumulation of new matter at
r orifices or bifurcations, but such as arise from the more
id deposition of large masses of fibrine upon a rough part of
artery, or from the loosening and inversion of an osseous
te, or the washing of a detached cardiac vegetation down the
rent. The first, occurring comparatively early in the disease,
be made up for by the establishment of a collateral circula-
n; the others happen suddenly, in which case even healthy
lateral arteries sometimes fail to preserve the life of a limb.

OCCLUSION OF ARTERIES.

ome other causes of obstruction to the current of blood
ain to be noticed, besides those by atheroma.

There are persons who, by certain postures of their limbs, are
le to stop the pulsation of their arteries. The radials and
ials cease to beat upon forcible flexion of the elbows and
ees. Others can so depress the clavicle upon the subclavian
tery, or raise that vessel by a forcible expiratory compression
the lungs, as to arrest circulation in the arm. Arteries dis-
aced with fragments of bone are often without pulsation until
e fracture is set. An exuberant osseous deposition around the
agments of a fractured bone may, it is alleged, compress

adjoining blood-vessels. The situation in which this has observed to happen, is the fibrous canal in the adductor m of the thigh. I have myself seen such obstruction (femoral, and gangrene of the limb, only where the arter was injured, or the fracture had not been replaced.

In like manner, that is to say by outward compressior bid growths in the vicinity of blood-vessels enfeeble or st circulation. An exostosis once grew on the first rib in relation to the subclavian artery as to give rise to the sy of an aneurism of that vessel, and lead the surgeon w charge of the case to tie the artery. Cancerous, an rarely the innocent, tumours, compress and obliterate ; trunks, which are found flattened, and either pervious cluded with coagula or adherent fibrine. Even gangre follow the occlusion of an artery from this cause. Thi ever, is a rare event, as time elapses before the com becomes complete, and blood, in some small quantity, co to be driven through the flattened vessel. The obliter aneurismal vessels will be found explained at large in t on ANEURISM.

One other cause of the occlusion of an artery rem consideration, that, namely, in which its canal is close impacted foreign body. The cases are now numerous i arteries have been found plugged by fragments of growths, which have been detached from one part of th lating system, and transported into some other part al stream of blood. The plug which is found occluding th vessel has often no organic connection with its walls, detained in its place merely by having reached an ar small to give it further passage. The accident is usua with in the aortic system, and the most common situati which such fragments are detached is the left side of th Many morbid vegetations adhere to the mitral and aorti loosely or by pedicles, and may be broken off by the blood into or out of the ventricle. Some, but smaller, fra may, as Mr. Lee suggests, be washed out of atheromato of the larger vessels.*

So long ago as 1837, it occurred to M. Legroux† to explain a case c obstruction of the arteries of the lower extremities by the passag ugs found in them from the heart. A similar explanation was given gier to the Anatomical Society of Paris, in 1849, respecting a yet kable case. A healthy young man died with a needle in the left his heart, and with gangrene of the left leg. The needle was found e apex of the ventricle, with its point directed towards the aortic covered with 'decolorised sanguineous concretions, very coherent r,' which were prolonged into the aorta. The lower end of the aorta, c arteries on both sides, were filled with an adherent clot. It seemed he plugging of the latter, and the consequent gangrene, had their e detachment of fragments of the lymph which had first adhered to * Since that time the researches of Dr. Kirkes have shown a rrence to take place in the cerebral arteries. Mr. Paget has demon- n the pulmonary arteries; and Virchow, Simpson, and others have uainted with it in other vessels.

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* Lee, on Gangræna Senilis, *British and Foreign Medico-Chirurg* vol. xx. p. 214.

† *Bulletin de l'Acad. royale de Médecine*, tome i. p. 434.

ident precisely similar in its nature, but occurring in ortion of the circulating system, is now known to be lly fatal in acute rheumatism, as well as to bring on fearfully sudden deaths in some puerperal women. The rtery in these cases is the pulmonary, or several of its and the plug is either formed in the right side of the passes through it from the systemic veins.†

ts from which the explanation of these occlusions of chiefly drawn, have already been partly stated: 1. The often healthy at the site of the obstruction. It may, e atheromatous, inasmuch as the occurrence in question nost in persons whose arterial system is diseased. Yet healthy, as might be expected if the disease originated . Sometimes the vessel is dilated to nearly twice its ize, and, in the branches of the internal carotid espe- s enlargement renders the situation of the plug evident artery is opened. 2. The plug is frequently not adherent sel. The cases under consideration were for a long time as effusions of lymph from the surface of an inflamed ut when the artery is healthy, and the plug free, that on is plainly erroneous. There are, indeed, not a few in which the coats of the artery are inflamed, and even on has taken place in the surrounding structures; in umstances, the plug is found adherent. The inflamma- ver, and the adhesion, are alike the result of the pre- ence of the plug. 3. The impacted plug can be distin-

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hier, *Traité d'Anatomie pathologique générale,* tome ii. pp. 201, 206,

c *Memoirs,* by Sir James Y. Simpson and his editors, Drs. Priestley vol. ii.

guished from the inflammatory lymph and coagulum which are formed in its immediate neighbourhood. Drs. Burrows and Rühle have given the most undeniable evidence of this fact, and have all but demonstrably traced the plug to another place of origin. Each of these observers detected a calcareous plug occluding an artery, and similar calcareous matter still attached to the wall of the heart.* 4. The cessation of the circulation in the occluded artery is too abrupt to have arisen from a gradual accumulation of fibrine. It has probably not always been discovered to be instantaneous, because the pulse has not been under examination at the moment of the occlusion. 5. The severe pain which first calls attention to the accident, and death as it happens from such obstructions of the pulmonary artery are both sometimes sudden. 6. After loss of sight from the cause, the twigs of the retinal artery are seen with the ophthalmoscope to be bloodless upon the distal side of the plug.

It would far exceed the limits of this article to trace the results of this accident in the various parts and organs of the body in which it has been shown to occur. As there is no trunk which may not be occluded by a detached plug, the abdominal aorta itself not escaping, so there is no organ which may not have its function impaired, or its structure destroyed, by the deprivation of blood which this accident occasions. Organs with single arterial trunks, as the testicle, retina, or spleen, may lose their function when thus deprived of their whole supply of blood.

When the principal artery of a limb is suddenly plugged in its higher part, severe pain is commonly the immediate result of the accident. In some cases this pain extends along the course of the vessel, which, though pulseless, is extremely tender; in others the suffering is referred to some distal part of the limb, as, for instance, to the calf. Signs of a deficient circulation succeed; and they may amount to pallor, loss of temperature, numbness of the surface, or even to that 'torpor' which in certain injuries of vessels is observed to precede the total death of a limb. Such torpor implies not only a loss of circulating blood in the limb, but also a cessation of feeling and motor power, and it may issue in actual mortification.

It is not every case of obstructed artery which terminates in gangrene. A collateral circulation may be established, and the life of the limb be saved. Very young subjects bear such an

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* *Medical Times*, 1853, p. 135; Virchow's *Archiv*, vol. v. p. 189.

nt without any ensuing mortification. An infant will
without loss of life the gradual obliteration of even the
itself at the termination of its arch. Mr. Savory has
ed an instance, probably congenital, in which 'all the
rteries of both upper extremities and of the left side of
ck were reduced to solid cords;' yet no gangrene oc-
.*

subjects of gangrene from an impacted clot have a
l feebleness of the system, which may account for the
ss and great mortality of it. Some persons die before
ine of demarcation is formed; more sink during the
s of separating the dead portion of the limb; a few
e until all its tissues are naturally severed, except the
and some tendons. Upon the division of these, the
may heal.

e at least of the obscurity which invests the subject of
angrene is cleared away, if obliteration of some of the
s be recognised among its causes. There are commonly
inary symptoms which may have indicated arterial
e: chilliness of the foot or hand, and frequent pains for
months, forebode the attack, and the gangrene at length
ates and advances by a local dusky inflammation. In
particulars the gangrene of the aged is unlike that which
denly produced in younger subjects by obstructed arte-
ut sometimes an arterial cause of senile gangrene can be
.

tment.—The occlusions of arterial trunks which are
l by external compression can rarely be relieved. For
nt tumours seldom interfere with the circulation, being
themselves grooved by an artery than compressing it;
alignant growths, when they have reached a size and a
n in which they can produce such an effect, are com-
unsuitable for an operation. No special suggestion is
ed for the treatment of arteries implicated with broken
and none can be offered for their compression in certain
ions by the growth of new bone about the fragments.
hief attention will necessarily be claimed by the manifest
of the obstruction, at the same time that all efforts must
ected to preserving the life of the limb by warmth and
able posture.

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* *Medico-Chirurgical Transactions*, vol. xxxix. p. 214.

In the treatment of arteries suddenly occluded, it may
possible at an early stage by reasonable pressure to break u
soft recent plug in a superficial vessel, that its fragments
pass into arteries of less importance to the limb. If this be
possible or proper, care must be directed to preserve the temp
ture of the limb, to favour the establishment of a colla
circulation, to maintain the efficiency of the blood by sui
nourishment, to relieve pain by methods which will least i
fere with the appetite, and, more than all, to guard the weak
limb from irritation, and injury, which might overtask the
vital power it still retains: these are the indications befo
occurrence of gangrene. When that event has comme
the course advised in the essay on that subject must be ad
If the mortification advance slowly, as in senile gangren
B. C. Brodie's recommendation of a calamine cerate
sloughing parts, and then swathing the entire limb for
three days at a time in a very thick layer of cotton wool
be adopted; it avoids exposure, and quiets the mind
patient. Poultices make the parts warm for a time onl
must be frequently renewed, whilst cotton wool preserv
limb at an equable temperature, and need not be dis
until the discharges from the part require removal.

The administration of opium is essential in these cas
account of the severity of the pain, and some patients p
a clean tongue and a fair appetite whilst taking it.
however, cannot continue to take it by the mouth, who c
procure refreshing sleep and other benefits by the subcut
injection of a little morphia.

The question of diet and stimulants in cases of gan
especially senile gangrene, has been warmly discussed.
advocates of an animal diet assert that any treatment
deteriorates or diminishes the blood in the system, and
fore in the limb, is promptly followed by an extension
mortification, and that the patient is strongest, and conseq
the life remaining in the limb is best maintained, with
nourishment, if only its quality and amount be rightly ad
to the digestive powers of the patient, and those pow
kept in proper order. With Sir Benjamin Brodie,* they
cate the administration of stimulants in moderate qua
that is to say, 'any quantity of wine that does not oc

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* *Lectures in Pathology and Surgery*, p. 368

f skin, nor raise the pulse, nor make the mouth clammy, nder the patient nervous or irritable, may be given with age; but whatever does more than this, does mischief.' e contrary, the advocates of a very sparing farinaceous egetable diet assert that it checks the gangrene, whilst imal diet and stimulants cause it to extend. The dis- cy between the two opinions, which have both been enter- by practical men, is probably to be explained by Sir B. 's caution not being observed. If these patients take and animal food, it is essential for them to have a el purgative every three or four days. Without such a ution the stomach may be disordered and the gangrene d; but both these evils are avoided in curable cases if the ution be observed.

e offensive odour emitted by the gangrenous parts should ercome by dry powdered charcoal freely sprinkled amongst cotton wool. Scales of pure iodine, contained in chip- s, and covered with muslin instead of a lid, are still more ive for the purpose. Being inodorous, it may be hung t the bed. Larger boxes of wood, with perforated zinc and filled with sawdust and carbolic acid, may also be into the bed. The suggestion of the iodine is from Mr. ffman of Margate.

hould the gangrenous limb be amputated? Surgical ex- ience and reasoning both prompt a general reply in the nega- e. In many cases, the obstruction of the artery is higher n the site of the proposed operation, as, for instance, in iliac arteries or the aorta. Amputation in such circum- nces can only be done below the cause of the gangrene, and parts which are ill-supplied with blood. Moreover, if the eration be performed on a level with or above the obstruc- n, as when the popliteal only is plugged, it is often un- ccessful; there still remains the constitutional exhaustion, e natural or the premature old age, or the disease of the art, under the influence of which the patient has to rally m the shock of an amputation. And further, the instances re not few, especially amongst the younger subjects, in which, a mortification ceasing, the dead parts spontaneously slough f. Except in special circumstances, therefore, amputation hould not be performed. The various events are illustrated in he following two series of selected cases; the first showing gangrene in the aged, and the second in younger subjects.

1. Gangrene attacked the arm of a middle-aged lady, who died e
a few weeks, before the separation of the dead parts was complet
aged seventy-two, was attacked with inflammation at the back of tl
which ended in black dry gangrene. In six months death had spr
causing pain, as far as the elbow; and in twelve months more, to tl
The limb was hard, as black as smoked meat, and without cada
In another month the arm dropped off without hæmorrhage, and
healed without discharge. . The man was alive and pretty wel
afterwards.*—Mr. Guthrie amputated low in the thigh for gang
extending to the knee. The femoral artery was plugged at the
stump did not slough; but the patient, an elderly lady, after a par
sank exhausted before it healed.†—Mr. Langstaff amputated a thi
tification of the leg in a man aged seventy-five. All the vessels
and could not be tied so as to stop the flow of blood. The pa
much exhausted, died within twenty-four hours.‡—Dr. A. P. Tho
a case of amputation in the thigh for dry gangrene of the leg in a
sixty-five. The arteries were pervious to the popliteal. The pa
the third day.—A man, aged seventy, died seven weeks after amp
thigh for gangræna senilis. It was unnecessary to tie any vessel i
tion; all were already plugged.§—Amputation in another case
for a time, but the soft parts took on no reparative action; the
retracted from the end of the femur, and the patient died.—
Exeter, amputated in the thigh for senile gangrene. The opera
lowed by 'constant tremor and subsultus, muttering delirium, and
relaxation;' yet the patient, a man of sixty-eight, eventually r
Some successful cases of amputation in senile gangrene were relate
sion at the Royal Medical and Chirurgical Society of London, in
Garlike of Rickmansworth, had removed the thigh, near the
months after the commencement of gangrene at the toes, the pa
course of his disease having likewise suffered from suppuration in
in the knee-joint. Mr. Adams had seen a man, over sixty years of
after a similar operation. Such cases are, however, rare, and cannot
as establishing a general rule of practice. Under peculiar circums
Mr. Garlike's case, amputation may be performed; but all that the
appear to show is, that the operation may possibly not be fatal in a f
in which the strength of the patient is not much reduced, and the g
existed for an unusual length of time. These, however, are just tl
which may be capable of a spontaneous separation of the dead part
majority of cases of extensive senile gangrene end in death, whethe
are amputated or not.

Two cases of gangrene of the lower extremity, in comparati
subjects, proved fatal in the Middlesex Hospital; the one under the
Stewart, the other of Dr. Goodfellow. The heart, and the whole of
implicated in its disease, have in each case been preserved as one
preparation, which exhibits at a glance the pathology of the occur

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* Alix, Altenburg, 1778: quoted from Mason Good, *Medicine*, 1
ii. p. 919.

† Hunterian Museum, 141.

‡ *Med.-Chir. Trans.* vol. vi. p.

§ Hunterian Museum, 2822.

‖ James, *On Inflammation*, p.

lypi in the left cavities of the heart, and detached fragments of the
mass plugging several of the arteries. In neither case had the ulcera-
ess deeply severed the dead and living parts.—My colleague, Dr. Seth
n, requested me to see a girl, of twenty years of age, whom he had
. into the Middlesex Hospital, on account of a rheumatic disease of the
he had loud mitral and aortic murmurs, acute adhesive inflammation of
posterior saphena vein, and a red, tender, and exquisitely painful swelling
wer third of the right leg. This inflamed patch had not suppurated; but
in it was intense, and destroyed her rest. An incision relieved her,
a few days a slough of fascia separated, and the wound healed with
ly little suppuration. Inflammation was next observed in the left
saphenous vein. Anasarca in both legs followed, and the face became
After a fortnight of great pain and much general depression, the left foot
became cold and dusky, and the ends of the toes shrivelled and turned
Complete gangrene of the lower half of the leg ensued, and a line of
tion formed. When nothing remained to divide but the bones and a
e tendon of the gastrocnemius, I separated them, and removed the fœtid
he stump had nearly healed when she left the hospital.—A seamstress,
nteen, ill-nourished, had acute spontaneous gangrene of the foot and the
g. There was no pulsation in the femoral artery. After amputation,
p and the groin sloughed, and the patient died. But one small artery
ligature in the operation, and the iliac artery was found plugged.*—A
hristian of Salsette, aged thirty-five, was affected with spontaneous
of the arm, and in eighteen days ulceration had deeply separated the
. living parts at the elbow, and had extended along the integuments
to the shoulder. The limb was amputated about four inches below
lder-joint, and the man recovered.†—A gangrenous leg was removed
tation in the thigh from a puerperal woman, aged twenty-five. Not
blood flowed at the operation, and the patient died the next day.—
er patient, aged thirty-nine, gangrene of the foot took place after
n, the thigh was amputated three months after the delivery, and the
ecovered.‡—A man, aged thirty, suffered from an 'epidemic malignant
hich brought on a mortification of the left foot. When ulceration
g on about two inches above the ankle, the leg was amputated below
. No blood flowed in the operation; but the stump suppurated
, and the man got well.§

CHARLES H. MOORE.

York Journal, Sept. 1854, case 6.
terian Museum, 2835.
pson's *Obstetric Memoirs*, edited by Drs. Priestley and Storer, vol. ii.
7, cases 23, 25.
ical Observations and Inquiries, 1764, vol. ii. p. 152.

ANEURISM.

PATHOLOGY.

An aneurism is defined to be a tumour containing blood, a communicating with the cavity of an artery. Thus in eve aneurism there are two parts to be considered, the sac* and i contents. The sac is formed either by the vessel itself, dilat from disease, or by the condensed soft parts in the neighbo hood.

The various classifications of aneurism now in common u are based upon varieties in the anatomy of the sac. The m natural nomenclature appears to me to be that which calls aneurism formed by the coats (one or more) of the artery a t aneurism, and one formed by the surrounding cellular tiss false aneurism. Unfortunately the term 'true aneurism' w applied by the older authors to a tumour in which all the co of the vessel were dilated, while they called one in which o one of the coats formed the sac 'a false aneurism;' a very in appropriate name, inasmuch as such aneurisms form the majorit of those met with in practice, while the term 'false' appears t convey the idea of something exceptional and peculiar. It i undesirable to complicate the matter still further by the attem to introduce fresh terms. I shall therefore adhere to the ol nomenclature, in spite of my opinion of its incorrectness merely observing that these anatomical refinements are of very little importance in practice; that no one troubles himself a to how many coats of the artery enter into the formation of t sac, or has any means of forming an opinion on the point befor dissection. But it is very important to ascertain whether th blood is contained in a sac or no, whether that sac is or is no perfect, and whether the aneurism is of spontaneous or traumati origin.

The term 'diffused aneurism' is also, I must confess, an in appropriate one as used to describe a tumour in which the sa is formed out of the cellular tissue; since such a tumour i as distinct and circumscribed as if the sac were formed by th

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[*] Some authors speak of extravasations of blood among the tissues of a limb from the giving way of an artery, as 'diffused aneurisms:' but this appears t me an error. I should term this lesion 'a ruptured artery.' The distinction, a I hope to show, is not a trivial one.

el itself; and accordingly in many works an aneurism is to be diffused when the sac has given way. Such an tion, however, is equally well or better described as 'a rup- d aneurism.' The term 'diffused,' serves indeed to remind at the blood, though now encysted, was once diffused among ighbouring parts; but as it is liable to be confounded the same term as used by other authors to designate sations from rupture, I shall prefer to use in the sequel me 'consecutive aneurism' for such aneurisms as have formed out of the tissues external to the vessel. In order as possible to avoid ambiguities, a Table is subjoined, ng the nomenclature adopted in this essay, as contrasted at hitherto common in France and England: M. Broca's being used as an example of the former, and the chapter eurism in Mr. Erichsen's *Science and Art of Surgery* for tter. (See the Table p. 412.)

kinds of aneurism to be described below are as follows:

Common or encysted aneurism, subdivided into
  (*a*) Fusiform aneurism, or aneurismal dilatation.
  (*b*) True aneurism.
  (*c*) False aneurism.
  (*d*) Consecutive or diffused aneurism.
Arterio-venous aneurism, subdivided into varicose aneurism aneurismal varix.
Cirsoid aneurism, sometimes called arterial varix. Aneur- by anastomosis will also be considered under this head.
Dissecting aneurism.

Common or Encysted Aneurism.

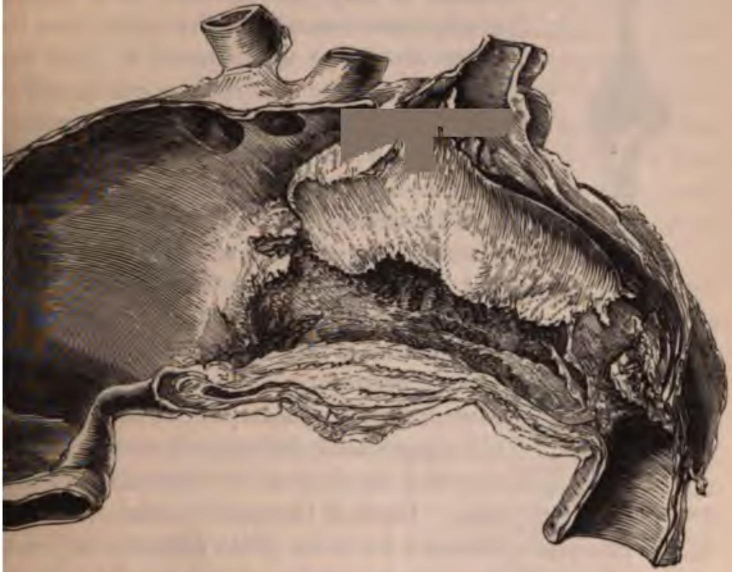
By common or encysted aneurism is meant that variety of the ease, embracing by far the greater number of cases, in which tumour is formed of a single cyst, communicates only with ingle artery, and is limited to a single point of the course that artery. Some of the subdivisions of this affection are ctically very different from each other, while between others difference is unimportant, and in fact usually inappreciable ring life.

In the *aneurismal dilatation*, or *fusiform aneurism*, the whole mference of the artery has yielded to the force of the cir- lation for some considerable length of the vessel, and so a mour has been developed, of an elongated or somewhat

TERMS USED IN THIS ESSAY.	BROCA.	ERICHSEN.
I. Common or encysted aneurism. The tumour forming a single sac, communicating with a single artery at a single point. Subdivisions:	Circumscribed aneurism.	
(*a*) Aneurismal dilatation or fusiform aneurism. The sac formed by all three coats of the artery dilated over a great extent.	This is excluded from Broca's classification.	Fusiform or t lar aneurism.
(*b*) True aneurism. The sac formed by all the coats of the artery dilated at only one point.	True aneurism.	True saccul aneurism.
(*c*) False aneurism. The sac formed by only one of the coats of the artery.	Mixed external aneurism; subdivided into *sacciform*, *fusiform*, and *dissecting*.	Circumscribed [illegible] ism.
(*d*) Consecutive or diffused aneurism. All the coats of the vessel have given way, and the sac is formed out of the neighbouring parts.	False, or encysted aneurism; subdivided into primitive and consecutive. Cystogenic aneurism; formed by a cyst developed in the thickness of the walls of the vessel, and afterwards communicating with its cavity. This is not recognised in either of the other classifications.	Diffused [illegible] culated [illegible] ism, [illegible] he [illegible] extrav[illegible] without [illegible] our [illegible] curism [illegible] tured [illegible]
II. Arterio-venous aneurism, formed by a direct or indirect communication between an artery and a vein. Subdivisions:	Arterio-venous aneurism.	
(*a*) Aneurismal varix; in which the communication is direct, no tumour being formed.	Aneurismal varix, or simple phlebartery.	Aneurismal v
(*b*) Varicose aneurism; where the communication between the vein and artery is through the intervention of a tumour.	Varicose aneurism. Two forms described; the one in which the tumour is formed by a dilatation of the vein (varicose aneurism by dilatation); the other in which the sac is a new formation—encysted or false consecutive varicose aneurism.	Varicose ism.
III. Cirsoid aneurism; formed by the convolutions of a single dilated artery.	Arterial varix.	Arterial var
IV. Dissecting aneurism; an affection of the vessel occasioned by ulceration of its lining membrane, and effusion of blood between the coats.	Dissecting aneurism, considered by Broca as a variety of false aneurism. Broca describes two kinds of 'diffused' aneurism, by which he means aneurisms without a sac. This, according to us, is a contradiction in terms. Broca's first form of diffused aneurism is described in this work as 'rupture of an artery;' his second as 'rupture of an aneurism.'	Dissecting ism. The same applies to sen's cl tion.

lrical shape, continuous with the cavity of the artery at ›nd. The coats of the vessel are generally much thinned and y atheromatous. This form of aneurism hardly ever con- much clot. It is of more common occurrence in the aorta, are in the arteries of the limbs; the most usual situations the aorta being the innominate, the top of the common

FIG. 155.



›rm aneurism, or aneurismal dilatation, of the aorta, half filled with laminated oagulum. (From the Museum of the Royal College of Surgeons, No. 1641.) To how the possibility of the deposit of clot in such aneurisms, and even of spon- aneous cure, with preservation of the channel of the vessel.

tid, and the inguinal portion of the external iliac and ›ral (p. 398). Some authors separate the aneurismal dila- ›n entirely from the category of aneurisms, and treat of it distinct disease; but no pathological distinction can be e between this and other forms of dilated artery which ld not be subject to endless exceptions and modifications, in practice this affection is often indistinguishable from the e' aneurism.*

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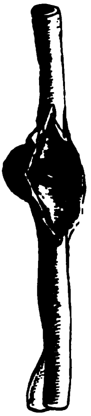
ome amount of dilatation, associated usually with atheroma, is constantly vith in the arteries of persons advanced in life; but this hardly constitutes ıour, and so does not deserve the name aneurismal. The arteries also ıe tortuous as well as dilated in elderly persons of relaxed fibre, and it

True aneurism is defined to be a circumscribed dila an artery in a part only of its circumference, in which coats of the vessel are dilated to form the sac, while called) *false* aneurism the two internal coats have gi and disappeared, and the sac is forn by the external, or cellular, coat. T aneurism, like the aneurismal dilata which it may be regarded as a va much more common in the aorta tha other vessel; so much more so that denied that true aneurism exists in a artery. It is difficult, however, to ref dence to the numerous authorities wl described the dissection of small i true aneurisms of other arteries in wh several coats could be actually demons but at a later period they become dated together at the neck of the s the internal layers cannot be followed having been worn off by friction, if the ever present: at this period, therefore is no appreciable difference between one ism and another as to their mode of tion. Even if the two internal coats followed for some little distance beyo opening into the aneurism, this d prove that it is a true aneurism, si part of the internal coats which can be traced may be that which would have lined the opening, and which h been everted into the sac. The presence of a smooth, s membrane lining the sac is no proof that the tumour is aneurism, since such pseudo-epithelial laminæ are very found in new formations,* and particularly where c

FIG. 156.



A small aneurism of the radial artery (Museum of the Royal College of Surgeons, No. 1697), to show the usual shape and relations of a common or encysted aneurism, which stands out like a bud from a portion of the circumference of the vessel.

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seems, from the account of a preparation by Mr. Coulson (*Path. So* vol. iii. p. 302), that this condition sometimes simulates an aneurismal The patient was a woman aged eighty-eight, who for some years be death had had a pulsating tumour, the size of an orange, just above t clavicle, in the situation of the carotid. It had been taken to be an but on dissection it was found that 'the vessels arising from the ao elongated, and considerably dilated; and the tumour consisted of a re tion of the common carotid and of indurated cellular tissue around it.'

* See Prescott Hewett, in *Med.-Chir. Trans.* vol. xxix. p. 80.

tion has been taking place. So that it is impossible to ceive any difference between true and false aneurisms at time at which they generally come under observation; and not worth while to say more on the subject, beyond stating the true become false as they grow; and expressing opinion, founded on the manner of their origin, that false urisms are far the most common.

Another form of false aneurism is described by authors of it, and must therefore be noticed here, although its reality ubtful. It is sometimes called 'hernial' aneurism, and the is formed by a projection, or hernia, of the two inner coats, ome portion of them, through a rent or an ulcerated open-in the external tunic. Whether the cases which have been on record really prove the existence of this affection, must ft to the reader to decide for himself. It is a point rather uriosity than of practical interest.*

he other form of encysted aneurism is the *consecutive* or *dif-*d, in which all the coats of the artery (or, as frequently pens, the sac of a previous aneurism) have given way, and blood is effused into the cellular tissue. The latter soon comes condensed, and forms, with the muscles, ligaments, cera, or bones in the neighbourhood, a sac for the blood, quently distinguished from those of the previous varieties by ng multilocular. The great majority of aneurisms are, if the ms be strictly construed, of the consecutive form; since few mours of long standing will be found in which some part, at y rate, of the sac has not been borrowed from surrounding sues.†

Such are the varieties of common aneurism, classified accord-

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* There is a preparation in the Museum of the College of Surgeons intended show this form of aneurism. Mr. Erichsen, however, reports, as the result his examination of this specimen, that he believes the external coat not to ve been originally deficient, but to have been dissected off; Cooper's *Surgical ctionary*, 8th edition, 1861, p. 140. In this opinion I quite concur. The line at hich the external coat has been cut away, is distinctly marked all round the neck the sac. M. Broca expresses his disbelief in the reality of hernial aneurism.

† I would wish, at the risk of being accused of repetition, again to remind e reader that the term 'diffused aneurism' is very often applied to a *ruptured* eurism, and even to a ruptured artery, *i.e.* to cases in which the blood is ured out into the cellular tissue, and infiltrates a great part of the limb with-t the formation of any sac. But I think that I shall be able to show reasons saying that it is more correct, and is of considerable practical importance, to arate these cases altogether from cases of aneurism properly so called, and to it that term to tumours provided with a sac.

[illegible]
that ought to exist between the expansive f
culation and the reaction of the wall of the
make the former preponderate. But none
events which are looked upon as exciting caus
can produce it without a predisposing cause
of the artery itself. This condition is, in the
cases, the result of *atheroma*; but on that stat
enough has already been said, and the reader
previous section. Any other cause which pr
atrophy of the artery renders it liable to dilata
phied part: Vidal† remarks that the accidenta
artery which ought to be deep-seated may i
both by weakening the coats of the vessel, a
it of the support of the soft parts. Unnatur
tinued pressure may produce the same effec
is recorded in which the pressure of an ex
aneurism.‡ The frequent occurrence of an
popliteal arteries strikingly proves the origin
in disease of the arterial system; the same th
strongly shown by a case which is recorded
of a popliteal aneurism in one ham, while the
for the treatment of an aneurism in the op
extensive disease of the arteries, a great nu
isms may form, constituting what is called
diathesis.'§

often happens, however, that aneurisms are found in ries which appear healthy in all other parts of their course; this seems to be more frequently the case, the farther the se is from the heart. In these cases the nature of the pre- osing cause is unknown. It has been alleged that mercury syphilis predispose to aneurism; but the assertion appears uitous. The abuse of ardent spirits is certainly an exciting e, and may possibly produce some weakness of the vessels, so o entitle us to consider it also as a predisposing cause. It orthy of notice that the disease is almost unknown in early ;[*] that external aneurisms (*i.e.* aneurisms of the limbs) are rare among women, especially in the higher ranks of life;†

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[*] A few cases are, however, on record. Mr. Hutchinson found an aneurismal y connected with the aorta of a child four years of age, which he was ed to attribute to the ulceration of a tuberculous abscess into the artery . *Soc. Trans.* vol. v. p. 104). Mr. Syme has operated for aneurism at the f nine (*Lond. and Edinb. Monthly Journ.* 1844); and a case of rupture of orta in a child aged seven and a half years, probably preceded by the tion of a small aneurism, is recorded by Dr. Armitage (*Path. Soc. Trans.* ix. p. 85). Mr. T. Smith tied the external iliac artery for femoral rism with success, at the age of twelve. See *Brit. Med. Journ.* March 16, 7, where a few other cases are referred to.

† Internal aneurisms seem equally, if not more common among women, when r way of life exposes them to the vascular excitement consequent on in- perance, vice, and mental emotions. Thus Dr. Rendle informs me that urism is a more common cause of death amongst female than male prisoners. is shown by the annexed Table, compiled from the records of the Queen's son, Brixton, all the inmates of which are prisoners under long periods of tence.

mber and Proportion of Deaths from Aneurism, of Convicts under Sentence of Penal Servitude: from January 1, 1854, *until December* 31, 1868.

ily average number of Convicts during the fifteen years 1854-68.		Number of Deaths from all Causes.		Number of Deaths from Aneurism.	
Men.	Women.	Men.	Women.	Men.	Women.
6,042·7	1,059·4	1,291	214	8	5

aths from Aneurism, calculated on a daily verage of 1,000; during the fifteen years 1854–68.		Percentage of Deaths from Aneurism, of the total number of Deaths during the fifteen years.	
Men.	Women.	Men.	Women.
1·3	4·7	0·61	2·33

and that such aneurisms are found most commonly upo
arteries which are most affected by the movements of the
while aneurisms generally are most common at thos
where the flexure, or the division of a large artery, oppo
sort of check to the blood-stream. The arch of th
especially at the dilated portion called the 'sinus mag
at the transverse bend, is the most familiar example of
occurring at the flexure of an artery; while the dil
the end of the common carotid, the common aneuris
lower part of the popliteal, and the tumours which
cœliac axis of the abdominal aorta, usually at the root
its branches, will illustrate the effect of division.
popliteal, and axillary artery seem most liable to diseas
the most constantly subject to stretching, and the
to forcible rupture. The constant impulse of the blo
against the arch must keep the root of the aorta in
motion than any other part of the arterial system.

The influence of forcible motion on the popliteal artery is show
periment of Richerand.[*] On a dead subject let the bones of the
be forcibly driven down into the ham till the ligaments are be
The middle and internal coats of the popliteal artery will be found
true that the accidents commonly cited as causes of aneurism are
as this rough proceeding; but slighter injury to the artery probabl
lays the foundation for subsequent dilatation.

Again, the heart is often hypertrophied, as the co
either of disease or of the habits of life of the pa
where the artery is weakened by any of the above cau
no longer resist the increased impulse. Hence a
regarded, with at any rate much probability, as a
effect of the wearing out of the artery by use; th
muscular fibres which constitute the strongest part o
of the vessel being, according to this theory, stret
partially separated. The fact that aneurism affects th
arteries only, *i.e.* only those vessels which convey red
led some authors to believe that the formation of thes
may depend in some unknown manner upon the qual
blood conveyed by the artery. With our present kno
vital chemistry it would be absurd even to affect

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[*] *Nosog. Chir.* vol. iv. p. 73. Hodgson, *On Diseases of the Arter*
ed. 1815, p. 64. In repeating this experiment, I have found that
occasionally true. I have sometimes found the artery entire;
occasion the external coat was somewhat lacerated, while the other
entire.

inion upon the possibility of this. It seems quite sufficient state that the pulmonary system receives the force of the ght ventricle only, which is seldom hypertrophied, and which, its strongest, is perhaps incapable of generating the expan- e force necessary to produce aneurism.

A case of aneurism of the pulmonary artery is on record in which the ductus riosus was pervious, and so red blood was admitted into the artery. But it not impossible that the force of the left ventricle might have been reflected ng the open duct.*

A more unmistakable case of pure aneurism of the pulmonary artery is the lowing, for which I am indebted to Dr. Rendle:—

The patient, a young woman, appeared in perfect health, when she was denly seized with acute pain beneath the left scapula. In two hours there s emphysema of the side; this rapidly extended over the back, chest, neck, e, arms, and even as far as one wrist. About three weeks after she brought blood, and died immediately. The left bronchus was pierced by a small angular opening close below the bifurcation, from which the air had escaped. e cartilaginous rings were bared and ulcerated from pressure of an aneurism f the pulmonary artery. The aneurismal sac was very small: not larger than a se-bean.

In some persons affected with the so-called 'aneurismal iathesis,' the whole arterial system shows an extraordinary endency to aneurism, without, as is said, any visible anatomical peculiarity in the vessels; but in ordinary cases of this diathesis the vessels are evidently soft and weak.

When, by any of these predisposing conditions, the wall of the vessel is sufficiently weakened, it will give way at the weakened part to the force of the circulation, and all the more surely if that force is temporarily increased by any unusual circumstance, which thus becomes an exciting cause. Hence, perhaps, the frequent occurrence of aneurism in persons of dissipated lives, and in persons who follow laborious occupations; by which not only is the heart's action unduly increased from time to time, but also the arteries of the limbs are exposed to frequent shocks. Hence violent mental emotion sometimes gives rise to aneurism.

Two cases of aneurisms of the abdominal aorta, dating in each case from the time of the patient's receiving sentence for a criminal offence, have come within the experience of Dr. Rendle, Surgeon to the Brixton Prison, who has favoured me with the following note: 'A strong healthy woman, five feet eight inches high, who had never before been in prison, received a sentence of transportation for life. *Immediately* on receiving sentence, and whilst standing at the dock,

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* On the connection between the quality of the blood and the deposition of atheroma, see the section on that head.

she almost fainted from terror, was suddenly seized with severe pai
epigastric region, and fell into the arms of an attendant. The pai
epigastric region never entirely ceased; and just six weeks after, a
tumour of small size was readily to be felt. This increased in size, un
as large as the closed fist. She lived for three or four years, being co
kept in bed and under treatment, and then passed from under my care
or four months afterwards (*i.e.* five years and two months after her s
she was found dead in bed. No post-mortem examination was perfo
the aneurismal nature of the tumour admitted of no question. This
so clearly traceable to the shock consequent on receiving a heavy se
to leave no reasonable doubt of the immediate cause of the disease.

'The second case was also an aneurism of the abdominal aorta at th
axis, and came on after receiving a severe sentence, though I could no
so distinctly to the sentence as in the first case. When I disco
tumour—the woman only complained of obscure pain in the part, an
her work when I saw her—it was about the size of a small orang
her at once to the infirmary, and had her put to bed. *Twelve hours a*
in bed, the aneurism ruptured, and she died in forty-eight hours.
post-mortem examination. Both patients were women between th
forty years of age, and otherwise healthy.'

Occupations which necessitate constant exercise of
and frequent strains upon its joints, act both as predispos
exciting causes of aneurism in the arteries lying near suc
Popliteal aneurism seems to be caused in very many i
by the giving way of the circular coat of the vessel un
alternate movements of forced extension and violent fle
which that artery is exposed in the movements of th
Suppuration near an artery may lead to the formati
consecutive aneurism, the wall of the vessel being perfo
ulceration, and the blood admitted into the sac of the
This seems to be a very rare event; but suppuration an
artery may also act as a predisposing cause, by denud
vessel, as has been already pointed out. Unmistak
stances, however, of abscesses converted into aneurism
record.

Mr. Liston's case is well-known,* in which he opened a cyst comm
with the internal carotid artery, believing it to be an abscess, and in
was obliged, in consequence of the gush of blood that followed the pa
place a ligature on the common carotid. The patient died of secon
morrhage, the result of the operation; and on post-mortem exami
Liston found reason to believe that the disease was originally an abs
had established a communication with the artery. Whatever may b
of the real nature of the tumour in that case, there can be little d

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* *On a Variety of False Aneurism.* London, 1842. An interesting ca
hæmorrhage from communication between an abscess in the neck and t
is recorded by Mr. Busk, *Med.-Chir. Trans.* vol. xxix. p. 297.

ral of the other cases which are related in Mr. Liston's paper were genuine nces of communication between abscesses and arteries.* These abscesses may the result of struma, cancer, or common inflammation. In the 34th volume the *Medico-Chirurgical Transactions* is a very interesting case by Mr. Dixon, which a hydatid cyst, having been laid open, sloughed, and so established a munication with the subclavian artery. The patient died of hæmorrhage. is the ordinary result in cases of ulceration penetrating arteries. No aneur- is formed, since there is an open wound. But, in the rarer cases, such as those rred to above, the suppuration proceeds subcutaneously, and a consecutive urism is formed. Possibly Mr. Liston's case may have been an example of event; but the diagnosis must be allowed to be doubtful. The following nce was one in which the artery gave way without any known cause, there g no clear history of abscess, nor any violent effort or injury to account for laceration. A man aged twenty-nine was admitted into St. George's spital for a large purple swelling at the back of the pharynx, accompanied swelling and much discoloration on the front and left side of the neck. Two ys before admission, the patient while kneading some bread felt a stabbing in near the hyoid bone. In three hours' time the throat was so swollen that could not swallow food, and dyspnœa came on. After a short stay in the hospital, the diffused swelling of the neck became circumscribed, hard, and aller. There was evident pulsation of the tumour, with a whirring sound, hich only became perceptible as the tumour diminished in size and became rder. The patient went on well for a month, the tumour becoming reduced the size of a walnut, when suddenly it increased in size and extended in various directions. The general beating of the tumour gradually disappeared, leaving merely a line of pulsation in the course of the carotid. Great difficulty of swallowing followed immediately; the tumour became more and more tense, and the symptoms increased. The patient died of dyspnœa six days after the sudden increase in the tumour. The parts are in the hospital museum. In the preparation, immediately below the bifurcation of the carotid artery is a small opening in the vessel surrounded by a few minute patches of atheroma. There is a large pouch formed by the cellular tissue and fibrine of the extravasated blood, which completely pushes the larynx and trachea over to the right side, and encroaches much on the cavity of the larynx. There is no distinct rupture perceptible in the sac, but it is extremely thin at one point. It is formed chiefly by blood-clot, the fibrous investment of which is very thin.

It seems probable that the impaction of a clot of fibrine in the artery may lead to its dilatation behind the obstruction, and thus to the formation of an aneurism.

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* It may not be out of place to notice here the extraordinary omission in Mr. Liston's paper of any reference to auscultation as a means of diagnosis. He admits that, before he made his puncture, he had received 'a hint that the tumour might in some way be connected with the carotid;' yet he never seems to have listened for a bruit. Had he done so, there can be little doubt that it would have revealed the existence of a communication with the artery. An interesting case of aneurism which had been sent into hospital as an abscess to be opened, and in which the diagnosis was made by auscultation, is related by M. Richet in his article on 'Aneurism' in the *Dict. de Méd. and de Chir. prat.* vol. ii. p. 309.

Mr. Tufnell has put on record* a remarkable case, in which a pulsating tumour formed in the ham, in a patient who was dying from rheumatic disease of the aortic valves. The tumour subsided with simultaneous enlargement of the collateral branches; and after death the artery was found plugged with fibrine and somewhat dilated. In this case it seems clear that the artery, being

FIG. 157.

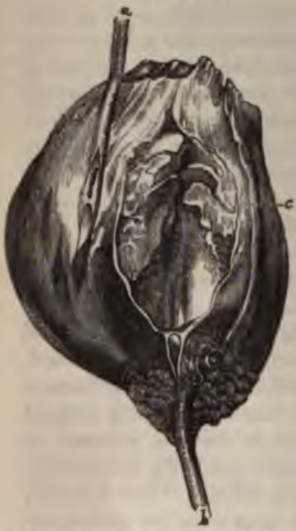
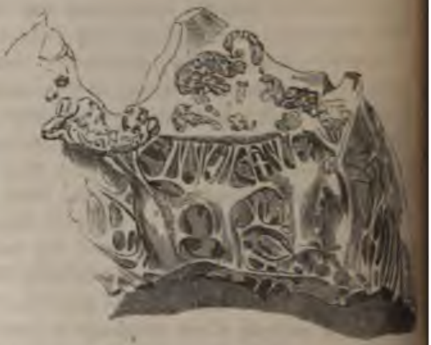


FIG. 158.



Aneurism formed by embolism. Fig. 157 shows an aneurism of the ulnar artery; *a*, *b* the artery, its lower end closed by clot; *c* the sac partly filled with coagulum; Fig. 158 shows the deposit on the lining membrane of the heart.

FIG. 159.

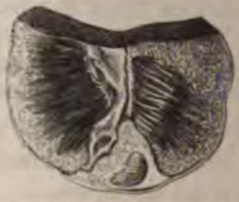


Fig. 159. A block of fibrine deposited in the kidney in the same case.

(From a drawing in St. George's Hospital Museum. Series xxi. No. 60.)

healthy at the part where the clot became impacted, yielded to the force of the (hypertrophied) heart to such an extent as to form a tolerably large pulsating tumour, but that, as the collateral circulation enlarged, it was enabled nearly to recover its healthy dimensions. Such a case is illustrated by the accompanying figures, showing an aneurism which formed on the ulnar artery of

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* *Dublin Quarterly Journal*, May 1853.

ged 17, who died under Mr. Pollock's care at St. George's Hospital in ear 1864. The deposit on the valves and the embolic clot in the kidney so shown. The spleen was similarly affected. The artery in other parts ealthy.* If the same accident were to take place in an artery enfeebled eromatous degeneration, no doubt the aneurism would go on increasing.

e objection which has been urged against this mode of tion of aneurism, viz. that aneurisms do not form on ies suddenly obstructed by ligature, is an unsound one, they do so form, although rarely.† In most of these cases eurism produced by embolism the artery is previously sed.

these various exciting causes some have added pressure the artery, and consequent obstruction of the circulation, ndinous or ligamentous bands crossing it below, or by the of muscles; instancing the pressure of the fibrous arch which the soleus arises as a cause of popliteal aneurism.‡ h are the causes, predisposing and exciting, of spontaneous ism. The term 'traumatic aneurism' is usually intended clude only those instances in which aneurism follows a d known to have been inflicted upon an artery; and this d is, of course, in the great majority of cases, an open one. ch a case, the wound in the skin usually unites under ure; the issuing current of blood prevents the lips of the e in the vessel from coming together, while the reaction of eighbouring parts, the pressure of muscles and fasciæ, and upervention of syncope from loss of blood, prevent the un- d infiltration of blood into the cellular tissue, and the of the patient from that cause. The blood, being thus ed in, quickly loses its more fluid part by absorption, and es a more or less solid body, and is encysted in the same s other foreign substances. In other cases no skin-wound ; of which the most common instance is the wound of a by a fractured bone, and here the process of formation of neurism is the same. The form of aneurism is, therefore, onsecutive; and, *vice versâ*, most consecutive aneurisms aumatic. Many are, however, spontaneous, being caused r by ulceration perforating an artery, as alleged in Liston's or (which is very common) from the rupture of a previously

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e also a case reported by the writer in the *Path. Soc. Trans.* vol. xii.

ee WOUNDS OF THE VESSELS, vol. i. p. 739.

erneuil, *Bulletin de la Société anatomique*, 1835, p. 268.

existing aneurism. It has been above noticed that many, if not most, of the aneurisms which surgeons have to treat are, in one sense, traumatic, as having been probably caused by injury; the term is, however, usually restricted to those cases in which the vessel is known to have been penetrated, and will be so used in the sequel.

Progress of aneurism.—When once formed, the tumour is likely to go on increasing as long as the conditions subsist in which it originated. These conditions vary so much, according to the state of the sac, of the parts around it, and of the blood which it contains, that it is impossible to form a clear idea of the disease without studying each of these separately.

The changes in the sac depend in a great measure upon the position and size of its communication with the artery, and somewhat upon the direction in which the sac grows and the part of the artery in which the opening is seated: thus, sometimes the opening is situated on the concavity of the curve of a vessel, so that the artery is stretched over the tumour; more frequently on the convexity or bend of the artery; sometimes the arrangement of the neighbouring parts is such that the tumour can only grow in the opposite direction to the current of blood, or that pouches are formed in it. It would carry us beyond our limits to refer to instances of such arrangements, and to point out the variations in growth and progress to which they seem to have given rise. In a fusiform aneurism, in which the orifices of exit and entrance are free, the lateral pressure upon the sac cannot be severe. Hence these aneurisms advance slowly, and do not readily burst. On the other hand, pedunculated aneurisms, in which the sac communicates by a narrow channel with the arterial stream, are seldom found of large size, having usually burst before they attain anything like the size sometimes reached by the aneurismal dilatation.* The reason of this fact, no doubt, is, that the impact of the stream of blood through the narrow orifice (supposing that orifice unobstructed) is concentrated more upon one point, instead of being diffused over the whole wall of the sac, as in the previous variety. Between these two extremes there are, of course, all possible shades of difference; but in every aneurism, properly so called, as distinguished from a mere dilatation, the pressure on the

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* Rokitansky, *Path. Anat.* Syd. Soc. vol. iv. p. 280.

the sac is much greater than the natural pressure of the rt.

is may be illustrated by a reference to the scientific toy known as the static paradox,* in which a small pipe communicates with a closed ws, the pipe and bellows being filled with fluid. The smaller the opening e bellows, the greater is the pressure on its walls. An aneurism standing like a bud from the artery, and communicating with it by a small opening, d bear a resemblance to this machine, though not a strictly accurate one, regurgitation would go on in the aneurism, which is not the case in the wa.

n addition to this it may be remarked, that these small nings are sometimes, perhaps always, formed by the giving y of small portions of the atheromatous wall of the vessel. h small atheromatous patches are sometimes met with in g tracts of healthy artery, where the wall is thin and weak, d where, therefore, a small and weak sac soon forms, and is ble soon to burst.

It does not necessarily follow, however, because the wall of aneurism gives way, that the tumour therefore bursts. The ocess is usually a gradual one; and as the old wall is thinned d absorbed, inflammation proceeds in the tissues surrounding e sac, and, by condensing them, supplies the tumour with a w envelope. On minute examination of most large aneurms, it will become evident that portions of their sac are rmed by cellular membrane, muscles, and other tissues, which ve originally been distinct from the tumour. In other cases, d especially when the tumour has perforated a bone, its dden increase marks the occurrence of a large rent in its alls, and the supervention of a large consecutive aneurism pon the original disease.

Another very important element in the condition of the sac of n aneurism, is the nature of the parts by which it is surrounded; nce, when the tumour meets with the resistance of bone or ther dense tissue, the sac is absorbed or worn away; whilst, hen it presses upon organs which are very sensitive, or whose nction is important, reaction and inflammation are soon exited by the pressure of the increasing tumour; and in such ases, if the inflammation does not pass a certain limit, perhaps onsolidation may ensue, otherwise ulceration will take place. A singular complication of aneurism is where the tumour pro-

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* Or hydrostatic bellows. The machine will be found described in most treatises on hydrostatics; *e.g.* that in the *Encyc. Brit.* 8th ed. vol. xii. p. 81.

jects into the cavity of a neighbouring vessel, usual
pulmonary artery, or one of the cavities of the heart.
ulceration seems to take place early, unless the pressur
sac produces death. When veins lie contiguous to an an
they are usually closed by the pressure of the tumour.
however, are on record in which an aneurism has burst i
cavity of a vein. This circumstance will be again ref
in the section on arterio-venous aneurism.

The changes which take place in the neighbouring
due either to the pressure of the tumour or to the infla
which it excites. The growth of an aneurism is often
that the effects of its pressure are very striking.
closed, nerves expanded and thinned, muscles stretc
wasted, bones roughened or perforated, and even the s
sometimes so atrophied as to give way. When aneur
duces irritation in the surrounding parts, the latter ma
or suppurate.* The sac is also usually involved in th
and then the aneurism is opened by the separation of th
or the bursting of the abscess. This is usually accom
fatal hæmorrhage; but it may lead to the spontaneou
the disease, as will be pointed out under that head.
difference often observed in the progress of internal
according as it presses upon a mucous or a serous su
been well shown by Dr. Gairdner.† The hæmorrh
duced by the ulceration of an aneurism into a muco
as the pharynx, œsophagus, or intestine, usually proc
a minute orifice, and occurs by small quantities at a
opening being very liable to obstruction by a clot;
opening on a serous surface, as the pleura or perica
often, perhaps usually, a large rent, through which ra
hæmorrhage takes place.‡ Surgical aneurisms do
often come into contact with either of these classes

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* Roux, *Quarantes Années*, vol. ii. p. 260, relates a case in which
that an abscess formed over an aneurism, and communicated wit
case, however, must be allowed to be somewhat dubious. Anothe
clearer case of an abscess forming over and opening into an aneurism
may be found in Broca, op. cit. p. 166.

† *Med.-Chir. Trans.* vol. xlii.

‡ Mr. Obré relates a curious case, in which an aneurism ulcerat
pericardium by three small openings, each of them only about larg
contain two bristles. Death was rapid in this case; but had a sim
tion occurred into the pleura, life might have been sustained for a c
period, or the openings might have closed. (*Path. Soc. Trans.* vol.

e, but the synovial cavities bear a great analogy with the
s, in this as in other respects; accordingly, hæmorrhage
the bursting of an aneurism into a joint is generally rapid
profuse. Two cases of great interest will be found in Dr.
dner's treatise, in which the spontaneous opening of an
rism through the skin was followed by healing of the
e, and in one case possibly by a cure of the disease; and
r instances are on record in which aneurisms have been
entally opened without ill effects—nay, in some with good
t, from relief of the tension. It is more usual for an
rism to communicate with one of the large mucous cavities
e body, than with any other part. Then the progress of
ptoms usually is, that a slight hæmorrhage occurs, which
weakens and alarms the patient to some extent. The
ing then ceases, whether from syncope, from displace-
t of parts creating obstruction, or from plugging of the
ing by displaced clot; but this cessation is temporary:
fissure reopens and enlarges, and the patient dies exhausted
r a few recurrences of bleeding. Sometimes the bleeding
rs in such a situation,* or in such quantity, as to extinguish
in a moment; but these cases are usually under the care of
physician. Surgical aneurisms, when they burst, usually
n into the cellular tissue or into a joint. In the latter case
eding is generally copious, and the cavity becomes so much
tended that pulsation is felt in it. The bursting of an aneur-
a subcutaneously is usually accompanied by great pain, and
rapid and gradually increasing hæmorrhage, producing faint-
s and syncope; but the symptoms and treatment of these
cidents will be more fully considered hereafter.

Another termination of a growing aneurism, which is fre-
ently met with in those affecting the extremities, is by gan-
ene, the result of pressure. This takes the case out of the
tegory of common aneurisms, and it must now be treated like
y other tumour producing gangrene. Aneurisms may remain
ationary for a long period, though this is extremely rare.
ometimes, after the apparent cure of an aneurism, *i.e.* after
t has ceased to pulsate and become stationary, it will again
ommence to grow, and the pulsation will recur; and in a case

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* See, in the *Path. Soc. Trans.* vol. x. p. 84, two cases in which aneurisms of the abdominal aorta burst, and the blood was effused around, and constricted, the œsophagus in one case, and the duodenum in the other.

of this kind, which has furnished a preparation to the mu
of St. George's Hospital, increase of size was noticed wi
any return of the pulsation.*

In that case the artery had been tied above the tumour, and the in
the latter, which was very marked, from the size of a hen's egg to th
egg of an ostrich, and which continued during twelve months, l
suspicion that the diagnosis had been mistaken, and the disease not a
but malignant. However, the tumour became at last stationary and
the cure lasted during the rest of the patient's life, about one ye
death, the accuracy of the original diagnosis was established. In th
cause of the absence of pulsation was obscure; but pulsation may
be absent merely in consequence of the position of the opening; a
cases no bruit may be audible, the orifice being at the deep su
tumour, and the force of the stream probably broken by clots. S
case in a woman under Mr. Vincent's care at St. Bartholomew's
whom an aneurism followed the occurrence of a longitudinal
posterior tibial artery, on its anterior face. The sac being fo
posterior part of the artery, the stream of blood seemed to enter
Hence probably the absence of pulsation. Nor was there any
diagnosis, therefore, was only made, after a long course of trea
exploratory incision, when amputation became immediately nece
indebted to Mr. Moore for the notes.

The changes in the blood contained in the sac are
important than those in its walls. They refer to
and amount of clot formed in it. It is this clot
strengthening the wall of the aneurism, enables it to
action of the heart, and so opposes further increase,
by its constant increase in size and density (fresh cl
as the old contracts), encroaches upon and finally obli
cavity. As this is the only cure of which the disea
except by ablation or in the very rare case of sponta
by sloughing, it is to obtain the deposition of a
coagulum that all the efforts of surgeons and physic
treatment of aneurism are directed.

In examining an aneurism after death, two kinds of
will be found in it. The one, which lines the sac, and
very firmly united to it, is tough, more or less decol
laminated, much resembling layers of different-colour
The laminæ, and the differences of colour, obviousl
gradual and successive deposition. This laminated c
now frequently called, after Broca, 'active clot.'†

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* Prescott Hewett, *Med.-Chir. Trans.* vol. xxix. p. 75.

† The name does not seem a very well-chosen one, since it i
process than the clot which deserves to be called active. Looki

is soft, amorphous, and red, something like currant-jelly,
is always found inside the former. This soft clot (otherwise
ive clot') may be a mere post-mortem appearance; but it
o doubt often formed in aneurismal tumours during life.
ertain no doubt that the soft amorphous clot is the first
in the formation of the laminated fibrinous coagulum;
hat it must be so in some cases is proved by the fact that
risms are sometimes cured by pressure in a very few hours.
r in those cases, there has been no time for the formation of
nated coagulum. The sac must in the first instance have
filled with soft clot, and it seems in the highest degree
able that the soft clot has often become gradually hard
laminated.* The formation of soft clot, however, is not a
ter of the same importance as that of laminated coagulum;
ed, a too rapid deposit is perhaps in some cases to be
recated, as leading to a delusive appearance of cure. It is
le to be either melted or washed away by the circulation,
then the tumour, which seemed to be cured, begins to grow
in.

It will be remembered that the first phenomenon of atheroma
sists in the deposition, out of the fluid blood, of a fibrinous
atum on the wall of the artery. The commencement of
gulation in an aneurism bears, at any rate, a strong resem-
nce to this; but, unlike the formation of atheroma, it seldom,
ever, takes place where the sac is exposed to the full force of
e blood. The least diminution of the circulation, however, as
m pouches in the sac, from roughness of its walls, or from
ternal causes moderating the impulse of the heart, will lead
the formation of tough fibrinous coagulum on the wall of the
eurism, though what is the exact physical cause of this coagu-
tion is unknown. It seems to require for its commencement
diminution of the circulation, but not its entire stoppage;
deed, it sometimes seems to go on less readily when the stream
stopped altogether. When once this tough fibrinous coagu-
m is formed, it has a tendency to propagate itself through the
ntiguous layers of blood until the whole sac is full, unless the
ream of blood should be too strong for it; and when once
rmed, the clot acquires greater density, partly by the inherent

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t, which has remained for years unchanged in a cured aneurism, one would
inclined to say that nothing could well be more *passive*.

* See Richet, 'On Aneurism,' *Dict. de Méd. et de Chir. prat.* vol. ii.
282-295.

of this kind, which has furnished a prep
of St. George's Hospital, increase of si
any return of the pulsation.*

In that case the artery had been tied above th
the latter, which was very marked, from the size
egg of an ostrich, and which continued duri
suspicion that the diagnosis had been mistaken,
but malignant. However, the tumour became
the cure lasted during the rest of the patien
death, the accuracy of the original diagnosis w
cause of the absence of pulsation was obscur
be absent merely in consequence of the positi
cases no bruit may be audible, the orifice l
tumour, and the force of the stream probabl
case in a woman under Mr. Vincent's care
whom an aneurism followed the occurren
posterior tibial artery, on its anterior fac
posterior part of the artery, the stream of b
Hence probably the absence of pulsation.
diagnosis, therefore, was only made, after
exploratory incision, when amputation bec
indebted to Mr. Moore for the notes.

The changes in the blood contai
important than those in its wall
and amount of clot formed in i
strengthening the wall of the an
action of the heart, and so oppos
by its constant increase in size a
as the old contracts), encroaches
cavity. As this is the only cur
except by ablation or in the very
by sloughing, it is to obtain
coagulum that all the efforts of
treatment of aneurism are direct

In examining an aneurism aft
will be found in it. The one, wl
very firmly united to it, is toug
laminated, much resembling la
The laminæ, and the differenc
gradual and successive depositi
now frequently called, after B

---

* Prescott Hewett, *Med.-Chir. Tra*

† The name does not seem a very
process than the clot which deserves

something lik[illegible]
ter. This soft clot [illegible]
-mortem appearance [illegible]
isual tumour [illegible]
morph[illegible]

ceeded
etween
which
flamma-
partial
sorption
cure by
ed also to
rent cure,
sometimes
cases it is
but allowed
portion of it

arteries in the
ements worthy of
e of all the cases
till more extensive
great interest and
e usual course and
for the purpose of
they always include
Dr. Crisp's table of
erous as those of the
mer, the proportion of
ater than thoracic—an
lative frequency, with
published and miscel-
hospital registers; and
all, it would only give
is perhaps hardly worth

EURISM.

ists essentially in dis-
ween the force of the
e arterial walls at the
fills the aneurismal sac
hen the full force of the
that the disease is one
cases; for the coagula
in contact with the wall
nection with it, and thus
ited, enable it to resist the

power of contraction possessed by fibri
it were, hammered out by the impetu
interesting to compare different part
fibrine accumulates in strata; there,
the surrounding soft parts, the peric
careful study of the parts will gener
to the impact of the stream of bloo
the surrounding parts; the attritio
subjected easily explains its absor,
absorption, it seems that the clot m
to say, that even laminated coagul
of the sac, be removed—an effect wh
to anything but the action of the
But if the vessels of the sac can re
also deposit it—that is, may not the
the clot be an exudation from its v
precipitate out of its contents?
pathologists,* who consider the pr
to inflammation. But if it were
ought to be the oldest, having
increasing deposit; now every-da
and consistence proves that the
exact cause, however, of the forma
allowed to be obscure. It is enou
know that in an aneurism such cl
tendency to form, and will for
extent when the full force of the c
Even in tumours which are rapid
coagula in parts where the strea

The nature of the connection
of fibrine, is another obscure poi
an interesting passage of his v
prove that the laminated clot fo
certain grade of vitality, howeve
adduces to prove the vascularis
appear strictly applicable to aneu
Blandin have injected clots in a
nan in a concretion forming in
both these cases there are evide

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* Colles 'On Aneurismal Sacs,' *Dublin*
Wardrop, article 'Aneurism,' in Costell

† Op. cit. pp. 127 seq.

rism; nor have I succeeded
oof that vessels pass between
; nor with any facts which
the vital actions, inflamma-
nd them, except the partial
very likely is an absorption
clot; so that the cure by
e, may be expected also to
[illegible]

her the
expan-
the clot
tumour is
rm of the
nunication
fluence on
by a mere
ave a much
hich stands
it by a kind
true, com-
which the
a very large
most common
ch more prone
m. Then the
effect on the
ernal coat pro-
blood finds no
ditions, with a
artery, the force
hologists believe,
d on the smooth
hy arterial coats
sms never contain
is. The figure on
any rate sometimes
possible to discover
mbrane at the point

chanical lesion, and
nical means chiefly,
n the advantage that
relative quantity and
. It is true that the
ce coagulation directly
ly failed; but methods,
h increase the relative

---

its lateral expansion, *i.e.* the
Hence the fusiform dilatation
nd is not prone to bursting.

conditions or proximate causes of spontaneou above. The first is the mere retardation o This may take place under conditions which i foresee and therefore to produce; but the c always accessible requisite is *rest*, which has known to effect the cure of aneurism, whethe ternal, with little assistance from any other m

Such an instance is the following: A man was ad under the care of Mr. Luke, on account of a tubular ane artery, unaccompanied by bruit or affection of the pulse in limb. The tumour was of a year's standing; it was comp emptied of its contents. A plaster and bandage were ap not so firmly as to produce much pressure, and he was deal of pain was felt under the plaster for half an hou five days, and at the end of that time the tumour was fo tion had ceased in it and in all the arteries of the limb. examination of the patient, two months afterwards, the pu not reappeared.†

A great number of such cases might be cited authors who have treated this subject. Henc given by a medical man to a patient in whom existence of aneurism is to keep quiet. It is recommendation is not made more stringen instead of being merely enjoined to lead a qui all causes of excitement, should be rigidly con to the recumbent position. But a still more consists in spare diet, though this should neve as an auxiliary to rest.

The following case deserves notice as illustrating the pos in a condition usually regarded as quite hopeless.‡ A sub milk, and light pudding. At first the tumour seemed to grow; but Christmas of that year its walls gradually got harder, the pulsation ished in force, and by March 1848 were no longer perceptible externally. then left his bed, having become by this time very pale, emaciated, and He lived very abstemiously for four years and a half, when a general on 'excited him to deviate from the tranquil and abstemious habits he ed.' He died of acute pleurisy after exposure. A large sac was communicating with the aorta by an opening (1 in. by 1½ in.) just below nominate artery in the posterior wall of the vessel. There was only a large enough to contain a horse-chestnut, the rest was all filled with coagulum. The tumour had been of enormous size (7½ in. from side to and 4 in. vertically). The disease which proved fatal appears to have been unconnected with the aneurism.

Bleeding is also a powerful agent in this plan of treatment. a remedy now little used, in consequence of its abuse in time of our fathers; but it may be permitted to us to doubt ther the reaction has not been carried somewhat too far. btless the repeated and copious venesections of old times ld hardly be otherwise than injurious. Valsalva, it is said, d to bleed his patients day after day till they were unable to nd, and could hardly raise their arms from the bed.* This an excess to which our modern habits as well as the prejuces of our patients, would effectually prevent surgeons of the esent day from resorting; and there can be no question of the nger and impropriety of bleeding, when so insisted upon.† t the moderate use of venesection appears both rational and, far as we can judge from recorded cases, successful. Bleedg seems to increase the relative amount of fibrine in the blood;

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* Hodgson, op. cit. p. 145. Some writers have thought that the usual reesentations of Valsalva's practice are exaggerated; but it is clear, from lbertini's account (*Acta Acad. Bonon.* vol. i.), that its general principle is rrectly understood.

† M. Broca seems favourable to the application of the method of Valsalva in e treatment of aneurisms of the thoracic and abdominal aorta, and of the sublavian artery. I do not observe, however, that he has given any instances of e application, successful or otherwise, of this method, except one, the refernce to which I have been unable to verify; nor have I met with any instance f the application of Valsalva's method, properly so called, in modern practice. n a case brought before the Pathological Society, by Dr. Broadbent (*Path. Soc. rans.* xiii. 44), dyspnœa, the result of an aneurism of the aorta, had been uch relieved by bleedings practised at rare intervals; but this is of course uite a different thing from Valsalva's treatment. Porter speaks of having led to syncope, several times, a patient with aortic aneurism, and always ith marked relief: op. cit. p. 82. In Mr. Hodgson's work numerous cases ill be found quoted, where a practice more or less closely resembling that hich goes by the name of Valsalva was followed with success.

nor does it appear, when moderately used, to lessen its bility; while its effect on the power of the heart and of the circulation may be calculated with some appr certainty. That this effect is transient is very true, the action of all the cures for aneurism. A transie on the circulation is all that is needed for the form laminated clot, which will then, in favourable circumsta on to extend itself. Besides, bleeding has the recomm that it can be repeated, and its quantity proportioned e the condition of the circulation. The great objection appears to be, that (in internal aneurisms especially, b aneurisms to some extent) the antagonism between th action and the forces acting in the tumour has a ten cause stoppage of the heart, and death from syncope.* especially likely to happen in the fluttering action which copious venesection, and it is on this account mainly th ing is dangerous. Still, there are too many records by and those the most competent, observers, to allow of do its great utility, in some cases, although probably in this, many other things, the acute judgment of Sir T. Watso the mark when he says that venesection is only admissib as to reduce *excessive* arterial action. For this purpose i tainly a more manageable and more certain agent than Dr. Stokes has suggested a modification of Valsalva's tr in which the small and repeated bleedings which prescribed are retained; but the diet is opposite to Va 'It should,' says Mr. Porter, to whom we owe our know this suggestion, 'be light and very nutritive, but of cou from any material of a stimulating nature.' (Op. cit. p. does not appear that any marked success has attended t

The medical means available for the cure of aneurism, those just enumerated, are very few. Certain drug retard the circulation have been used for this purpo without much success. Digitalis is both dangerous certain. The action of tartar emetic, or of copious purges, seems only to be to produce weakness, which done with less distress by the means above enumerated. of the alkaloids exert a remarkable influence on the

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* 'An apprehension has been entertained by some, that a patient reduced to a state of syncope might never rally, and actually die of, or by, the operation; and perhaps such a casualty may have occurred.'—P *Aneurism*, p. 83.

; such are aconite and veratrum.[*] Whether these ever been used in internal aneurism I am not aware, would seem worth while to give them a cautious trial. ouillaud has published a clinical lecture[†] *On the Treatment eurism by Iodide of Potassium.* Four cases are related, which were benefited and one was thought to be cured. e not myself perceived any benefit from the use of this y, though I have occasionally prescribed it for long ds of time, gradually increasing the quantity to enormous . The acetate of lead has been recommended by Dr. O. [‡] on the authority of a case of popliteal aneurism in which ther treatment was employed, and the tumour gradually olidated as the patient was brought under the constitutional ence of the drug. My own experience of this plan also is, ret to say, negative; but I regard it as the most hopeful e medical means available for the treatment of aneurism.

is possible that an aneurism, though beyond operative rference, may still be accessible to local applications (*e.g.* at root of the neck, or in the chest); in such a case, ice may applied to the tumour. Some surgeons use refrigeration, as accessory to pressure, in the case of external aneurism. The thod is one of doubtful efficacy. I have seen it tried asionally, but without any effect. It should not be for- tten, that gangrene of the skin has been so produced.[§]

It seems to follow from the above facts that when aneurism beyond operative interference, the best thing that can be done to keep the patient quiet in bed for months, and years if d be, avoiding all causes of excitement, mental and bodily; administer a light, unstimulating diet, but without denying n sufficient nutriment; to keep the part in such a position may rather impede the supply and favour the return of od; to use venesection in small quantities, and carefully, en the circulation appears at all above the normal standard, ich, it should be remembered, ought to be below that of alth; and, finally, to surround him with an equable cool

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[*] On the action of veratrum, see *Lancet*, vol. i. 1862, p. 21.

[†] See *Brit. and For. Med.-Chir. Rev.* Jan. 1860. Another successful case is erred to in the *Am. Journ. of the Med. Soc.* Oct. 1865, under the care of Dr. wall of Canada. Here, however, starvation and absolute rest in bed were o employed.

[‡] *Lancet*, 1865, vol. i. p. 280. Another successful case is related by Dr. Daly the *Lond. Hosp. Reports*, iii. 179, where, however, absolute rest and local cold ere also used.

[§] Broca, op. cit. pp. 249 et seq.

have been wrought by such-like medical mean
perhaps, the cases will not be many, yet so
spared by the judicious use of such means,
sacrificed were the opinion acted upon that
necessarily fatal one, for which art can do noth

The second method of spontaneous cure,
(p. 432), is that in which the artery is presume
above the sac by the direct compression which
it by the aneurism. It is thought that a tum
narrow neck from the artery, may fall back,
the latter and close the vessel. This conclusio
dissection of cases principally of popliteal a
have advanced to a large size, and have then be
by clot. It may be remarked that, from the v
case, such dissections must always be subject
inasmuch as, at the period of the dissection,
advanced to such an extent that it is hardly
where it began; and that appearances near
identical are found in tumours where it is cl
pressure could have been exercised; and fu
explanation arose from those false views o
of arteries which led surgeons, some years
inflammation of their internal coat as a co
pressure,* and obliteration of the artery the
mon, if not a necessary condition of the cure
by pressure.† So it was thought that the pr

dissected in which pressure has been used, whether suc-
lly or not, that an artery will bear, without the least
alteration of its lining membrane or of its calibre, an
t of pressure many times greater than could be exercised
y tumour (see Fig. 161). We know also the ease with
h arteries elude the gradually-increasing pressure of tu-
s; nor are dissections wanting in which arteries placed
e conditions supposed are found to be completely pervious.

h a preparation exists in St. George's Hospital Museum. It exhibits an
ous popliteal aneurism, which seems to have undergone a process of
taneous cure. Its size, however, was so great, that the pressure produced
e veins occasioned gangrene. The man was admitted on this account:
rge solid tumour in the ham was thought to be malignant, and the limb
mputated.* The case occurred many years ago. No further history is
rved. The artery, which has been raised by the tumour and stretched
it for several inches, is nevertheless quite pervious. It communicates with
neurism by only a very small mouth; and though the limb has been
ted, hardly any of the injection has passed into the sac, so firmly is the
th of the tumour sealed by clot. In this case, if ever, it might be expected
the artery would be obliterated: since the tumour, being of immense size,
t have exercised great pressure, and the blood showed a strong disposition
agulate.

It may be, however, that this method of cure is only possible
en the artery is caught between the tumour and the bone, as
ight happen when popliteal aneurism is developed on the pos-
rior face of the artery; but it is hardly conceivable that the
mour should ever exercise very vigorous pressure towards the
ne in such a case, since it meets with so much less resistance
the other direction. For these reasons, the existence of this
ethod of cure seems doubtful. It is, at any rate, a matter of
tle practical importance (though no doubt of much patho-
gical interest), since no one would dream of encouraging the
rowth of a popliteal, or other accessible aneurism on the specula-
on of its ultimately curing itself by pressure on its own artery.

A more clearly proved mode of cure is that which is produced
y the impaction, in the distal portion of the vessel, of a portion
f clot from the aneurism. The occurrence of this circumstance
n the arterial system in cases of fibrinous concretions on the
alves of the heart, as pointed out by Dr. Kirkes, has now been
niversally admitted, and is a frequent cause of gangrene, of
oftening of the brain, &c. (see p. 403.) It seems also to be a
not infrequent cause of the obliteration of arteries below an

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* A similar preparation has recently been placed in the Museum of the Royal College of Surgeons.

aneurismal tumour, followed in some cases by gangrene o limb (or by death if situated near the heart), in others b spontaneous cure of the aneurism. The way in which this result is produced appears to be as follows: If a branch off from the artery between the aneurism and the part at the clot is impacted, this branch may enlarge until it re the original artery, and the whole process may remain w result. But if no such branch comes off (as is the case great majority of instances, since the impaction usually just as the artery leaves the aneurism), then the whole f the heart, as far as it acts on the artery affected, is empl dilating the sac, the artery above it, and the branches latter. Sometimes the sac yields to the force, and the a bursts, especially under undue muscular exertion.* If t not take place, and the circulation through the limb is go on, the branch or branches above the aneurism, a communications or anastomoses with the artery below enlarge. When this is effected to a sufficient extent, force of the circulation is withdrawn from the aneuris will then usually undergo the process of coagulatio quite obvious that it matters nothing to this process below the aneurism the clot may be impacted, provide considerable branch comes off in the interval, since t mediate portion of artery exercises no influence on the tion, and may, for the purpose of this argument, be reg part of the aneurismal sac. This process of spontane is imitated in the methods which bear the names of and Fergusson.

This plugging process may go on gradually as well as as is proved by its being found occasionally complete i who have never presented the serious symptoms accompany the impaction of a clot in a large artery; more clearly, by its being sometimes met with in an condition, the artery being lined with a tube of fibri still leaves a small channel for the blood.† It seems that the existence of another aneurism higher up m times effect the spontaneus cure of the lower one, consequence of clot being washed down from the upper the lower, or into the artery as it enters or leaves the lower or (as it is said) by the retardation of the current caused the upper aneurism. It is difficult to be certain as to ther the latter mode of cure ever really occurs, though cases on record which appear to prove its occasional occurrence. , at any rate, possible, since feebleness of pulse in the limb w is a constant symptom of aneurism. In the other case, when a piece of clot is washed out of an aneurism above, the cess exactly resembles that which has just been described. here remains another process by which aneurisms have been wn to become cured; and this consists in the suppuration of sac and the ejection of the whole tumour by a process of ghing. In this process, as in other instances of sloughing, artery, for some distance on either side of the gangrenous t, is closed by coagulum,* so that hæmorrhage does not take ce, as might have been apprehended.† Or, in other cases, sac may slough, and the artery, not being thus sealed, may e way, and the patient survive the hæmorrhage thus occa- ned; syncope is produced, and coagulation occurs during this ncope, sealing the mouth of the artery. This, at least, is Dr. risp's opinion, but it is doubted by Broca; nor do I find ferences in Dr. Crisp's work to the cases upon which such an pinion is founded. Inflammation without suppuration, in the ighbourhood of the sac, is also spoken of by Broca and others‡ an occasional cause of spontaneous cure. I have not been ble to find any cases which are, to my mind, quite satisfactory. Some, as the case reported by Mr. Sidey,§ appear to have been cures by impaction of clot.

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* Such seems to be the true explanation of a case reported by M *Path. Soc. Trans.* vol. iii. p. 88, as an instance of pressure by the the artery above it.

† See above, *Atheroma*, p. 397.

The surgical treatment of aneurism, as far as it is successful and rational, is merely an artificial imitation of these processes. The treatment by gradual and partial compression of the artery above the tumour, has no other aim than to imitate nature in the first of the processes described above, so as to slacken the circulation through the aneurism, and allow the blood in it an opportunity of coagulation. The Hunterian operation has essentially the same object, although it accomplishes it in a somewhat different way, and by obliterating a portion of the artery above the tumour puts a more decided, but at the same

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* See MORTIFICATION, vol. i. p. 155.

† See the cases related by Hodgson, op. cit. pp. 103–5.

‡ Richet, *Dict. de Méd. et de Chir. prat.* ii. 291.

§ *Edin. Med. Journ.* vol. iv. p. 768.

Sir W. Fergusson's plan of manipulation, or crus
from observation of cases in which the natural c
or attempted, by the impaction of a clot in the
the sac. Brasdor's method, so far as it is jus
practice, *i.e.* with the modifications hereafter
is identical with this in its object, and rests
pathological basis. Direct pressure appears t
usually by displacing portions of the clot, an
sometimes act by setting up inflammation in
around it, which leads to coagulation. Finally,
by opening the sac and tying both ends of the
strongest analogy to the cure by suppuration,
kind of excision of the tumour.

The methods of spontaneous cure have bee
this length with the view of impressing upon
reader that all successful plans of treatment are
being imitations (whether designed or fortuitous)
processes, in the hope that this fact may lead p
more careful study of the workings of nature in
and the conditions under which she works.
carried on by various observers, could hardly fail
results which would lead to the preservation of
that would be sacrificed to the idea that intern
disease almost necessarily fatal. What else was
ful study of the natural process of cure that le
brilliant and daring proposal of tying the arter

over all other methods of treating popliteal aneurism. Let us not forget that one of our most justly valued authors on this subject * was so satisfied with the advance which had been made at the time he was then writing, as to express his opinion that the improvements that had been effected in the mode of applying the ligature to arteries have brought the surgical treatment of aneurism to a degree of perfection which leaves but little room for advancement.' Nor was such an appreciation of modern surgery at all exaggerated or unreasonable to those who looked at it, as Mr. Hodgson did, by comparison with the mortality after the old operation. In our time surgery has made such rapid advances, that the mortality, which under the system praised by Mr. Hodgson must have amounted to a large percentage of those operated on,† is now very much reduced by the invention of instrumental compression, and even this will no doubt soon be further reduced by the more frequent use of flexion and digital pressure. So it may be in medical practice. At the present day, it is hardly too much to say that a patient with internal aneurism is condemned to death as certainly as one with external aneurism used to be to amputation. A century hence, we may hope, our descendants will have as solid reason to boast of their improvement upon the science of Watson and Latham as we have to congratulate ourselves on our advance upon the doctrines of Pott.

The extent to which the deposit of clot in spontaneously cured aneurisms proceeds, is one of the most curious and beautiful instances of that power of adaptation which the many processes of disease in the body furnish in such abundance to our notice. Generally speaking, the fact of the completion of this deposit implies the entire obliteration of the aneurism and of the artery for some distance on either side of it; and so great are the resources

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* Hodgson, op. cit. p. 190.

† I am aware that in Dr. Crisp's tables the mortality of 110 cases of popliteal aneurism operated on by Hunter's method is given at twelve only, and in seven of the others amputation was necessary, and succeeded. But there is much danger in drawing conclusions from lists formed of published cases, which usually (perhaps it may be said always) include far too large a proportion of successful operations. From the comparatively few cases I have myself witnessed, I should suppose that the mortality is nearly double that which Dr. Crisp's table gives. But such questions can never be settled till our large hospitals can be persuaded to make efficient arrangements for the preservation of complete and unbiassed statistics. A very different computation of the mortality will be found further on.

of the collateral circulation, that any part of the arterial
beyond the first three great branches of the aorta may be, an
been, obliterated without compromising the life of the pa
Thus, numerous cases of obliteration of the thoracic aorta
this point have been recorded ; the innominate artery has
been successfully obliterated by nature, though only once
by art, and a case is even on record* in which the cœliac
and all its branches, with the commencement of the s
mesenteric, were involved in the obliteration of an ar
seated on the abdominal aorta, without any loss of vit
the viscera, which must (although the fact is not state
been nourished from the phrenic arteries on the one ha
the inferior mesenteric on the other.

But these great channels of vital supply, though in fa
cases they may be stopped in this gradual manner with
of life, cannot be so without extreme danger. In rare in
however, we see that the cure of the aneurism proceeds
an extent as to insure the sac against the force of the
tion, but that a channel is still left by which the bloo
as it used to do through the healthy artery.

Of this a striking instance is figured in Mr. Hodgson's work†–
aneurism of the femoral artery which has been coated throughout w
layer of laminated fibrine, while a channel is left in the centre, thro
the circulation has been carried on, just as if through the natural art

Another case of this species of cure was exhibited by the presen
the Pathological Society, and may be found described in their *T*
vol. ix. p. 172. The preparation in St. George's Hospital Museum
aneurism of the cœliac axis, of which no complaint was made and no
existed while the patient was under observation during life. It ha
far filled with laminated coagulum that the walls of the sac are eve
great thickness, and there is only a small portion in the centre in
clot was loose and soft, filling it only partially, and no doubt formed
The three branches of the cœliac axis spring from the distal extren
aneurism, and are in all respects natural. There could be no doubt th
tion had gone on through the central part of the sac, which had th
the original artery.‡

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* Hodgson, op. cit. p. 125.

† Plates to Hodgson, op. cit. pl. vii. fig. 4.

‡ See also Sir Astley Cooper's case related by Hodgson, op. cit.
preparations from two cases in the Hunterian Museum, No. 1641, whic
on p. 413, and Nos. 1687, 1688. The latter two preparations are a
show aneurisms of the internal carotid on either side nearly filled wit
clot. The history of the case extends over five years, and is reporte
Blane. The symptoms were all cerebral : dimness of vision, diplo
appetite, maniacal excitement, &c. Benefit was always derived fro
antimony, and abstinence.

Symptoms of spontaneous cure.—The symptoms of the occur- nce of spontaneous cure in an aneurism appear to vary cording as the cure is produced by the gradual deposition of minated fibrine in the sac or artery, or is the consequence sudden occlusion of the artery by clot. When it occurs by oughing of the sac, the progress of the disease is of course tirely different. Usually nothing is remarked, except that e pulsation becomes less violent, the tumour less prominent, d the sac, when emptied by pressure on the vessel above, more lid and resisting. Soon afterwards, in a time varying accord- g to their size and position, the anastomosing branches will felt enlarging, in most cases of superficial aneurism. When is is the case, the cure is generally not far off. The aneurism ll soon be found transformed into a solid tumour of much less an its original bulk.

Sometimes things go on differently; the cure being ushered by symptoms of great severity, principally disturbance of the nctions of parts supplied by the affected vessel, accompanied more or less pain, sometimes very severe.

Thus in a case of spontaneous cure of aneurism of the innominate artery, orted by Dr. J. W. Ogle,[*] the cure was ushered in by urgent head-symptoms, d complete unconsciousness. The carotid artery was found after death to ve been obliterated; and, no doubt, the head-symptoms coincided with and re caused by the impaction of a clot in the vessel supplying the brain. In a e of aneurism of the right carotid, involving, perhaps, also the root of the nominate, treated by Wardrop's method, and reported in his work *On Aneur- m*, p. 98, may be seen the account of a similar seizure. 'The patient was ken suddenly worse, and appeared to be dying; his countenance ghastly, and vered with perspiration; tracheal rattle, and inability to swallow.' Other vere symptoms were also present. He remained in this state for several urs, and then rallied. At the same time, it was noticed that the arteries of e right arm and forearm, which up to that time had pulsated more strongly an those of the left, had become pulseless. The only probable explanation this train of symptoms is, that a portion of the clot in the sac had fallen into e subclavian artery, and closed it. The arm was partly paralysed for some me; but ultimately the anastomosing vessels enlarged, and the patient was in l respects cured.

This process of cure by impaction seems generally to occupy a eriod of at least several hours; but it may be completed very apidly.

A man was under the care of Mr. De Morgan at the Middlesex Hospital for pliteal aneurism, which was treated by compression of the femoral artery. his gave him so much pain that he was with difficulty induced to keep the

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[*] *Path. Soc. Trans.* vol. ix. p. 167.

instrument on, and Mr. De Morgan, at his urgent request, was about t
artery. The house-surgeon was sent for in the afternoon, as the
complaining of so much pain that he insisted on taking off the in
The tumour was then seen to be beating violently. The pressure was r
Twenty minutes afterwards, when he was again seen, all pulsation ha
and it did not recur. The tumour, which had been very tense an
before, became softer; and in twenty-four hours the circumference of t
diminished one inch. The pain and extreme tenderness subsided at o
the arrest of the pulsation.[*]

The process of spontaneous cure is very often inter
A portion of the sac becomes strengthened by the depos
clot; but where the circulation is more active, the sac g
expanding, and either bursts, or causes death by press
neighbouring parts. Often, too, the clot, once formed, is
down by the force of the stream; or it has been kn
be dissected off from the wall of the aneurism, and ha
found inverted by the force of the current, so that the
portion of the clot, which had been moulded to the wall
tumour, was found turned towards its centre.

Of this, the following case is a remarkable instance. In the *Pa*
vol. iii. p. 46, 1850–51, is an account by Dr. H. Roe of a case of a
the anterior cerebral artery, which proved fatal, apparently from in
size and gradually advancing pressure on the brain. The tumour w
size of a hen's egg, and consisted of two parts; the upper (farthest
vessel) being almost translucent, and filled with soft yellowish fibrin
fectly laminated; while the lower compartment, which directly comm
with the artery, was filled with coagulated red blood, like that in t
and separated from the cavity on the upper surface by a dense lamin
of fibrine. This mass had attained a considerable degree of organisa
taining, with blood-discs, very numerous fibres. The convexities of th
were towards the artery and its special compartment of the cavity, or
their *concavities* corresponded with the upper part of the tumour. Dr
in a report on this specimen, believes that this peculiar arrangement o
resulted from the dissection off the wall of the aneurism of the
laminated clot by blood from the artery, and the subsequent inversio
clot; in fact, an interruption of the process of spontaneous cure.

In cases where the history can be followed, it usually i
that such interruptions correspond to, and are occasio

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[*] In another case under Mr. De Morgan's care at about the sam
which the tumour was rapidly enlarging, although pressure was
great an extent as it could be borne, he had intended to tie the artery.
morning of the proposed operation, however, the pulsation stopped,
according to the patient's account, and it remained absent for about
and then returned, but not with the same violence. The case ultim
well under pressure.

me unusual exertion or emotion of mind by which the circulation is unduly excited, or some accident in which, perhaps ing with a similar affection of the circulation, the tumour y have been directly injured. Reference has been made ove (p. 428) to a case in which the clot continued for a long me to grow without pulsation. In Mr. Prescott Hewett's count of that case, the reader will be struck by the fact, that e cure was not previously a sound one; that the pulsation urred twice at long periods after the operation; and that, erefore, the clot was probably formed under the influence of too powerful stream of blood, and so might be looser and s resisting than laminated fibrine usually is. Besides, the t that the patient was far advanced in phthisis might have odified the coagulability of the blood. Many other cases are record, in which clots, both after spontaneous and artificial res, have softened and appeared to become absorbed; but ses in which they grow without pulsation are rare.

In a case reported by Freer, *Obs. on Aneurism*, p. 106, and quoted by Broca, very large aneurism had been rapidly obliterated by pressure, but had never much diminished in volume. *Twenty-two years* afterwards, the tumour having grown during the interval to an enormous size, but without pulsation, it burst, and a mass of brown grumous material was discharged. The patient died, worn out by fever and suppuration. It may be noticed, that in these cases where the clot afterwards softens, it is usually remarked at the time that the aneurism does not diminish much in size after its apparent cure. This then is to be regarded always as a suspicious circumstance.

I have seen two distinct examples of this increase in size without pulsation—In one the artery had been entirely divided, and the sac afterwards gave way. Amputation became necessary from the bursting of the tumour through the skin. In the other the aneurism was nearly cured, but its size and the consequent obstruction to the circulation caused gangrene, and hence amputation was performed.

After the cure of aneurism is completed, *i.e.* after the whole cavity is filled with laminated clot, no further change takes place in the swelling except a decrease in size, very perceptible at first, while the fibrine is in the process of contracting, and which proceeds slowly for a considerable time, until the clot has assumed its condition of greatest density, in which condition it may remain during the rest of the patient's life. By this gradual contraction of the clot, small aneurisms are reduced to a size imperceptible to external examination, and sometimes can hardly be recognised even by dissection. The collections which used to be described as 'steatomatous or atheromatous tumours of arteries' were probably small cured aneurisms.

But in swellings of larger size the laminæ of the clot remain distinct, though usually decolorised, during an indefinite period. Other changes, however, sometimes take place in aneurisms which appeared to be permanently cured. These, probably, depend on the imperfect or loose formation of the clot; though later on, the wall of the tumour takes part in the action. Thus the clot may be found softened and changed into a grumous material (as in Freer's case), or suppuration may take place, perhaps, from the irritation of this decomposing fibrine, and the whole mass be ejected. This took place a year after the apparent cure of the disease in a case operated upon by Sir W. Lawrence.* Finally, the clot has been found more or less mixed with cretaceous matter.

SYMPTOMS AND DIAGNOSIS OF ANEURISM.

The symptoms of aneurism may be easily inferred from its definition. A tumour containing blood and communicating with an artery will, in all ordinary circumstances, receive pulsation from the artery; it will be situated on the course of the vessel and will be incapable of being removed from it; it will (so long as part of its contents are fluid) diminish in size when the circulation through the vessel is stopped by pressure on the artery above, while on the contrary, some increase in size may be sometimes observed when pressure is made below the tumour; and, after the circulation has been stopped and the tumour emptied as far as possible, it may be seen to fill again gradually, and in a certain definite number of beats of the pulse, when the pressure is withdrawn. Besides these symptoms, which may be observed in every case of external or surgical aneurism, the two following must be borne in mind, which, though not always to be found, are so constantly present as to make them of great value in diagnosis. First, that the pressure of the tumour, or the diverticulum which it forms for the arterial current, will usually cause a diminution in the force of the pulse on the affected as compared with the unaffected side; and secondly, that the pulsation is usually accompanied by a peculiar rough blowing sound, called the aneurismal bruit. The assemblage of these symptoms furnishes as decisive evidence of the n
of the disease as it is possible to have of anything not act

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* *Med.-Chir. Trans.* vol. vi. p. 204.

our eyes; and as it is rare for those which are most cteristic to be absent in external aneurism, the diagnosis not generally present any great difficulty. In internal ism, *i.e.* aneurism seated in the chest or abdomen, it is ifferent; the tumour is often imperceptible, or if percep- y percussion, or even by palpitation, yet the course of the is so far from the surface, and the tumour may extend dely, that it is impossible to be sure that the tumour ponds exactly to the position of an artery. The pulsation quently imperceptible, or may be derived from the near mity of the heart or great vessels, without any real con- on with them—a frequent cause of error in the diagnosis mours, especially in the abdomen. It is impossible to stop circulation above, and watch the tumour refilling; the ine- lity of the pulse on the two sides, though very useful as rroborative symptom, may be produced by a great variety ther causes, and the aneurismal bruit is very frequently nt. Hence, while the surgeon can usually pronounce a ctly clear and unhesitating opinion as to the existence of rism in the limbs, the physician is beset with so many ulties, that although they in general pay more attention to nosis, and therefore may be presumed to excel more in that ch of our art, the ingenuity of physicians has not suc- ded as yet in pointing out any unmistakable signs of internal urism; and in many cases, even where the strongest reason ts for suspecting its presence, it is impossible to come to rtain conclusion during the lifetime of the patient.

It is worth while to study the above-mentioned general ptoms of aneurism a little more in detail, particularly with rence to their bearing upon diagnosis. The diseases th which aneurism may be confounded are, tumours, or scesses, lying upon the course of large arteries, and malig- nt tumours of bone, which sometimes pulsate from the evelopment of large blood-cells in them; further, it is neces- ary to distinguish between aneurism and a mere enlarged and elaxed condition of the artery, in which pulsation is much ore perceptible then usual. In the first place, then, an neurism is a tumour contained in a cyst, or sac; it is therefore eparable from other parts, which latter, if no inflammation has aken place, can usually be felt to glide upon it, and is more or ss movable according to the depth of its connections and to e extent of its base. Next, as to the nature of its contents.

These are, perhaps, more commonly a mixture of clot and fluid than merely fluid blood, and it is rare, therefore, to find pulsation equally perceptible in every part of the tumour. The character of the pulsation, it must be remembered, depends on two things; on the nature of the contents, and on the condition of the orifice. The usual character of the pulsation of an aneurism is that of a wave, gradually swelling up and gradually subsiding. There is also a lateral expansion of the tumour, so that if the two hands be pressed on its opposite sides, they will be seen to separate as the aneurism expands. There is usually superadded to this general heaving, when the artery lies between the sac and the hand of the observer, a distinct line of more rapid and thrilling pulsation, which marks the course of the vessel. This may generally be observed very plainly in popliteal aneurisms which are growing towards the knee-joint, and have the artery crossing them. The heaving character of the pulsation in aneurism differs from the more rapid and simultaneous pulsation of all its parts in a vascular tumour, which pulsates from the presence of a number of large vessels, and in which, therefore, the movement commences at all parts of the tumour, instead of being propagated from one. It differs equally from the movement communicated to a tumour by a large vessel lying beneath it, which is simply a rise and fall. The extent and power of the pulsation in an aneurism depends usually upon the amount of clot in the sac; and thus the gradual decrease of pulsation may be watched from day to day, as an aneurism is becoming consolidated under the use of pressure.

Pulsation may be obstructed by clots lying about the mouth of the aneurism, and sometimes may be altogether absent, although the sac still contains fluid blood. These are the most difficult cases in respect of diagnosis, which is then inferential merely, and almost as obscure as in internal aneurism. The cause of the absence of pulsation in an uncured aneurism is often very obscure. In some cases it appears to be due to the obstruction of the mouth of the sac by loose coagula. In one case of popliteal aneurism, I thought that pulsation had disappeared in consequence of rupture of the artery and aneurismal sac during the use of flexion. A free rent in the sac, like the total rupture of an artery by violence, is usually accompanied by disappearance of pulsation. Sometimes the pulsation may even have disappeared, in consequence of the tumour having been spontaneously cured, and yet its size and interference unctions of the limb may cause the patient to apply for e to a surgeon who has not seen it during its earlier stages. uch a case as this the patient's account of the previous ptoms, if he be a person of intelligence, will be of great e, while, if he can give no account of the disease, the diag- s will probably be uncertain. Such was the case in the nt mentioned on p. 439.

e pulsation can be made to cease at once by pressure on rtery above the tumour—a character common, of course, ll tumours which derive their pulsation from the vessel, her by continuity with it or not; whether aneurisms, rged glands, abscesses, or anything else pressing on the y. Pulsation in an aneurism is always more powerful in the arteries leading to it, while the sac contains much . This is a consequence of the powerful reaction between ave of fluid and the walls of the sac (see p. 425).

e gradual return of the tumour to its full size, after it has emptied by pressure, the circulation having been stopped, other feature very characteristic of aneurism; and it is rtant to note the variations in this respect, which will be ved in an aneurism as it is gradually filling with clot. more fluid the sac contains, the more completely will it be ied, and the more readily will it fill. As the deposit of proceeds, the beat becomes less forcible, and the tumour s less in size on pressure upon the artery. It should not rgotten, that since pulsation is caused by the reaction h the parts around exercise against the impulse of the t, it depends for its perfection upon the integrity of the hence it is frequently not present at all when there is no s in rupture of an artery before a sac has formed. Thus, ase where the patient had been caught by some machinery otion, and the leg violently twisted, much ecchymosed was found in all parts of the limb below the popliteal e, but no pulsation ever appeared in this collection. The was amputated about a fortnight after the accident, on nt of gangrene, when the popliteal artery was found broken letely across. So in aneurisms which, after advancing ly, suddenly burst with a large rent, the pulsation often s completely; to recur, perhaps (if the accident is not when the rent has healed.*

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* See also the case on p. 421.

the bruit of an aneurism is usually a s
rasping or blowing sound, and cannot be ar
a healthy artery.

The pulsation communicated to a tumo
over an artery is an equable rise and fall, w
when the pulse is stopped, and recurs at the
the artery as strongly as ever. The pulsati
generally a wave of fluid, which, on the rem
the vessel, does not attain its greatest heigh
number of pulses, and which causes not m
of the tumour, but also an expansion in ev
surest diagnostic sign, however, is, that
dragged away from the vessel, while the an
this is not always the case, since the tumo
or too tightly bound down by fascia, or too
the artery, to be moved. To this it may b
swelling be an abscess, the symptoms of
sometimes be present; but the occurren
around, or in, aneurismal sacs must be kep
too great stress should not be laid upon the s
ration, as if they excluded the notion of an
case in which there is doubt whether the sw
or an aneurism, auscultation should be care
rough aneurismal sound will prove that, eve
the swelling communicates with the neighbo

ation may, however, be caused by the tumour being, as it were, enclosed teries. This was the case in a patient in whom Mr. Moore tied the common rtery, on account of a pulsating tumour situated exactly in the position of an ism of the external iliac artery, and having 'a rough and loud murmur.' section it was found that the tumour was formed by cancer deposited in of glands situated in the bifurcation of the common iliac between the l and external iliac arteries, closely bound down to those vessels, and larly to the external iliac, by an envelope of fascia, having the obturator beneath it, and perforated by the gluteal, sciatic, and pudic arteries. In e, though the question of aneurism or pulsatile malignant tumour was d, it was found impossible to establish the diagnosis of its cancerous ; nor, after death, could any means of diagnosis be suggested, except the urine in the bladder contained cancer-cells, which might perhaps have found by microscopic examination. But as the only specimen of urine had been seen was quite clear, it is possible that the cancer-cells might been only occasionally present; and it must be allowed that no means of ly diagnosing such cases are known at present, since, from its shape and , the tumour separated the fingers as it rose, so as to simulate the expan- ulsation of aneurism, and the sound was not appreciably different from is found in many aneurisms. Even had the tumour been more superficial, so surrounded and penetrated by large arteries, that its pulsation could ave been stopped by drawing it away. This was the fifth case in which ommon iliac artery has been tied in London; and, out of these five, it was the in which the disease was supposed to be of aneurismal, but proved to be of gnant, nature (*Med.-Chir. Trans.* vol. xxxv. p. 468). A case occurred in Paget's practice, which still more strikingly illustrates the difficulties of nosis which beset pulsating tumours lying near the large arteries in the omen. A man was admitted for pulsating tumour in the groin and iliac . Much doubt existed as to its nature. Most of those who saw it inclined he opinion that it was aneurismal; others thought it malignant. It was ided to cut down on the external iliac, and if the tumour appeared to be an ism and ascended too high to allow of this vessel being secured, then to the common iliac. The operation was performed accordingly: but the pelvis was found filled with a large mass, partly solid, and not pulsating, ich so displaced the arteries that it would have been hardly possible to tie common iliac. However, under the impression that the tumour was malig- t, the attempt was not made. The tumour fungated out of the half-healed nd of the operation, and the man died of arterial hæmorrhage. It was then nd that the tumour was really aneurismal, and partly consolidated.*

Mr. South † mentions a case of varix of the internal jugular ein, preserved in the museum of St. Thomas's Hospital, which encircles the artery, filling nearly the whole side of he neck, and notices the difficulties which must arise in such ases in separating the pulsation of the tumour from that of the rtery round which it is, as it were, folded. In the case of a arix, Mr. South thinks that it might be distinguished 'by

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* *Brit. Med. Journ.* 1858, p. 724.

† Chelius, vol. ii. p. 202.

following, but they are seldom or never all p
The bruit seems but rarely as well marked i
as in aneurism, and is often altogether al
however, as Mr. Stanley remarks,† 'that i
anæmia, also in diseases of the aortic valve
gitation, limited portions, or even the wh
system, without organic change in the ves
the stethoscope a murmur approximating t
of aneurism. And if, under such circu
should happen to form in any region of the
large artery as to influence its pulsations,
scope, the bruit or bellows-sound may be rec
as forcibly as in an aneurism.' 2. The p
more sudden, less heaving, and less expans
tumour, and is equally forcible over the sa
whether the latter be large or small; whi
bulk of the swelling and the force of its pul
decrease together. 3. The condition of th
the tumour is connected will often aid in th
in Mr. Stanley's case (*Med.-Chir. Trans.* v
plate of bone was found in the walls of the t
which I saw at St. George's Hospital some
pulsatile tumour of the ilium projected in
situation of the sacrosciatic foramen, and
many respects an aneurism of the gluteal a

t.* When an aneurism, on the contrary, eats through a e, it simply chisels out a hole in it; so that if the sac can be tied and made to collapse, the edges of the hole will be felt. These pulsatile tumours of bone appear to be always, and ain are usually, cancerous; so that the general symptoms of cancerous cachexia may be present, or some other cancerous our may be seen. In the pulsating tumour in the buttock mentioned, the presence of hæmaturia at a later stage of case revealed the existence of mischief about the kidney, ch was found after death to depend on the deposition in that n of a large mass of encephaloid cancer. It must be itted, however, that the diagnosis between pulsatile tumour aneurism is often a matter of the greatest difficulty, even if e possible; and that the diagnosis of cases of aneurism unompanied by pulsation, such as those mentioned on pp. 428, , is sometimes impossible.

wo cases which occurred lately at St. George's Hospital illustrate (among at many which might be quoted) the difficulties which beset the diagnosis ween aneurism and pulsatile tumour of bone. One was the instance of rism of the ulnar artery caused by impaction of clot, figured on p. 422. this case no operation was proposed, as the boy was in an advanced stage of iac disease, but the case was shown to the surgeons in consultation, and appearance of thickening around the ulna in the neighbourhood of the nour led the majority to regard the case as one of pulsatile cancer. The ond case was one in which almost all the symptoms of popliteal aneurism re present, though not very well marked—there being a distinct though not d bruit, and an expansive pulsation, though not a very powerful one. It thought more probable that this was a case of aneurism, in which the sac s partly full of soft clot; and although the possibility of pulsatile tumour s not denied, it was decided that the artery should be tied, pressure having en previously tried without benefit. The patient died some weeks afterwards f phlebitis, and it was then found that the disease was pulsatile cancer of the mur.

Diagnosis between aneurism and aneurismal dilatation.—The diagnosis between an aneurism and a mere dilatation is usually quite obvious, at least between extreme examples of the two. The dilatation is generally unaccompanied by any distinct tumour or by any aneurismal bruit. It contains no clot, and hence may be completely emptied by pressure on the artery above, filling at once when that pressure is removed; and there is usually no interference with the pulse in the arteries below the lisease.

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* In Mr. Stanley's case also the tumour projected on both sides of the ilium.

TREATMENT OF ANEURISM. THE OLD OPERATIO

The medical treatment of aneurism has been discussed s
ciently for the purposes of a work on surgery. It now rem
for us to consider the various plans of local treatment whic
in use in ordinary or encysted aneurism, and to point out, i
as our present experience enables us to do so, to what e
and in what cases each plan is likely to prove useful.

The first method of treatment, usually called the old o
tion, or the method of Antyllus, aims at the entire eradic
of the aneurismal tumour.* The operation is thus perfo
the artery above the seat of aneurism is to be comman
possible, by a tourniquet, or by the finger of an assistant;
an incision is to be made into the tumour, care havin
taken to expose it by a sufficient dissection of the sup
parts, should these involve any important structures; th
are then to be rapidly turned out of the sac, and the ori
which it communicates with the artery is to be searched
ligature is then to be placed on the vessel above and belo
aneurism. The opening of the vessel can be found by pa
probe from the sac, first upwards and then downwards, i
where a distinct sac is found; but in 'diffused' aneuri
is often impossible, according to Pelletan. When the li
have ulcerated through the vessel, and the cavity ha
filled up by suppuration and granulation, the tumour is n
extirpated.

Such is the description, in general terms, of an op
which, thus stated, appears simple enough. Its diffi
however, are often of the gravest character when the an

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* Perhaps I ought to mention another method of eradicating an a
viz. by caustic. Thus Nélaton destroyed a small bleeding tumour, resul
a ruptured traumatic aneurism of the palmar arch, by means of chlori
(*Journ. de Méd. et Chir. prat.* May, 1862). This method, however, ca
used on superficial tumours of small size and connected with small art

† Keyslère, a surgeon of Lorraine, but practising in Italy, and wh
to have reintroduced the method of Antyllus into Italy, used only one
above the tumour. Three of his cases are reported by Testa of Ferr
seems to have learnt the operation from him), of which two were su
Mazotti, who had seen Keyslère operate, used two ligatures generally,
always (Pelletan, *Clin. chir.* vol. i. p. 142).

eeply seated, when the artery communicates with its deepest , and when the sac contains recesses or is closely united to parts around. Besides its difficulty, it is often an extremely re operation, requiring an incision of extraordinary length,[*] ssarily involving considerable hæmorrhage, and leaving an rmous cavity to fill up. The records of ancient surgery that it used to be often a tedious and desperate proceed-, which sometimes proved fatal on the spot, and the success which was at all times very uncertain. Hence it has been rseded in almost all cases, and few living surgeons have h experience of it. In popliteal aneurism, for which it used e the only cure except amputation, it is now completely ndoned, having given place to milder and more certain thods. In femoral aneurisms, compression or the ligature of external iliac would always be preferred; and so on for t of the common species of surgical aneurism. There are, wever, some situations in which the old method still holds its ound in the estimation of at any rate some surgeons. In illary aneurism it has lately been recommended by the high thority of Mr. Syme, and enforced by the example of his ccessful application of it. In aneurism of the gluteal artery, hould that rare disease be met with, many surgeons would refer cutting down on the sac and turning out the clot, espeially in a traumatic aneurism, to the still more dangerous peration of securing the internal iliac artery;[†] and in traumatic aneurism at the bend of the elbow, if the disease resisted the proper application of pressure, it would perhaps be considered more safe to open the sac and tie the artery above and below, and would involve no more danger to life. Besides these, cases will every now and then be met with in which the diagnosis having been uncertain the tumour is cut into with a view to tying the artery above and below it, if it prove aneurismal, or amputating, if it be cancerous.[‡] In some cases also

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[*] In a successful case, Pelletan made an incision ten inches long in operating on a recent popliteal aneurism, which is not stated to have been of remarkable size.

[†] But the diagnosis must be made with certainty. See above, pp. 452, 454. In Mr. Syme's *Observations in Clinical Surgery*, 1861, pp. 165–173, will be found two interesting cases of gluteal aneurism, treated, one by the old operation, the other by ligature of the internal iliac artery, and both with success.

[‡] Gay, *Lancet*, 1868, vol. i. p. 780.

it lay and to the constitution of the pati
turned it out, not merely that they might fin
artery, but also, and mainly, in order to rid
so dangerous a secretion; and stuffed the cav
which they believed to have the property
reproduction of coagulum. All this theory i
now; and if the operation were undertaken
there was much clot, the only object of the
ing that clot would be to find the mouth of t
the clot has been disturbed and exposed to
to remove it; and thus a large cavity is left
the extensive suppuration which this invol
large percentage of the great mortality af
Gangrene was very common after the old ope
aneurism, possibly from the difficulty of disti
from each other, and the consequent freque
vein and sometimes the nerve also was includ
Another and a very frequent cause of death
bility to secondary hæmorrhage involved in th
to be practised on diseased arteries. When
aneurism, this objection does not apply, since t
to be healthy in the neighbourhood of the wo
part; but spontaneous aneurism usually occ
of atheroma in that part of the vessel; it is
that the ligatures will be applied to a brittle,

the tumour is the most insecure place at which an
n can be practised; and this was the main theoretical
which set Hunter upon thinking of a new operation for
m.* The practical reason was doubtless the excessive
ity occasioned by the above-mentioned causes, and by the
rhage during operation, which, in all cases where no tour-
t could be applied, was frightful, and sometimes instantly
† and which was often severe even when the artery was
anded above the tumour, since, in a deep sac, it was
ssary to let the vessel bleed in order to find its mouth.
at the mortality was after this operation, practised as it
ally was in the popliteal space, we have no means of judging,
ept by consulting the works of those surgeons who, like
lletan and Roux, have left the records of their individual
perience; and it cannot be too often repeated that such data,
ough useful in many respects, are untrustworthy as statistics.
atistics of operations to be of any use or authority must be
unded not on cases arbitrarily selected for publication, not
ven on the individual experience of distinguished operators,
owever fully and frankly given to the world, but on the general
experience of large hospitals, embracing every case indiscriminately for a long series of years.‡ This has never yet been fully effected, and till a very few years ago was entirely unthought of. The mortality of every operation in ancient times must have been high, since the after-treatment was far more arbitrary and artificial than at present; but what the

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* 'Mr. Hunter, finding an alteration of structure in the coats of the artery previous to its dilatation, and that the artery above the sac seldom unites when tied up in the operation for aneurism, so that as soon as the ligature comes away, the secondary bleeding destroys the patient, was led to conclude that a previous disease took place in the coats of the artery. . . . Mr. Hunter, from having made these observations, was led to propose that the artery should be taken up at some distance from the diseased part, so as to diminish the risk of hæmorrhage, and admit of the artery being more readily secured, should any such accident happen. The force of the circulation being thus taken off from the aneurismal sac, the progress of the disease would be stopped; and he thought it probable that if the parts were left to themselves, the sac with its contents might be absorbed, and the whole of the tumour removed, which would render any opening into the sac unnecessary.' (Hunter's *Works*, vol. iii. pp. 596, 598.)

† Roux, *Quarante Années*, &c. vol. ii. p. 46.

‡ If it were possible to obtain reliable and unselected data from private practice, they would of course be equally useful; but this as yet has not been found possible.

proportion of deaths may have been we cannot now ascertain. Pott, in the well-known passage referred to on p. 442, says of this operation: 'I have tried it myself more than once or twice; I have seen it tried by others; but the event has always been fatal:' and Wilmer of Coventry said that in the year 1780 there had not occurred in this country one well-authenticated case of success. However, in Pelletan's *Clinique chirurgicale* (vol. ii. pp. 117-144) there will be found notes of four operations of his own and six practised in Italy, in which success is claimed in no fewer than seven cases; and in Roux's *Quarante Années* (vol. ii. p. 468) the only two recorded cases of the operation on the popliteal or femoral artery by opening the sac were successful. It is probable, therefore, that Pott's view of the mortality of the operation was too gloomy; although the immediate success of the introduction of the Hunterian operation shows that the old method must have been far more fatal. Now the Hunterian operation on the femoral artery, as practised at present, gives, as we shall see, a mortality equal, or nearly so, to that of amputation of the thigh;* consequently the proportion of deaths after the old operation must have been something frightful.

The risk of hæmorrhage during the operation is a very formidable one when no tourniquet can be applied. Mr. Syme, however, has succeeded in several cases in getting through these dangerous operations without fatal hæmorrhage by the same expedient as he uses with such success in tying the vessels for wound; a proceeding to which the operation under consideration bears much analogy. He opens the sac at first by a moderate puncture, which allows him to introduce a finger into the sac and feel for the opening of the vessel. If the puncture is not large enough, he dilates it so as to get in one and another finger,† until the point is discovered at which the pressure of the fingers arrests bleeding. Meanwhile the opening in the skin is of course plugged by the fingers which have been thrust into it, so that no great gush of blood takes place. When the orifice of communication between the sac and the vessel has thus been commanded, the sac is opened freely and cleared of clots. Then the vessel is raised with forceps, if it is fairly ble, and tied. If the artery is not exposed, the operator st keep his finger still pressed on the orifice, while, with the of his assistants, he scratches away the tissues that obscure Further reference to these operations will be made in the tions treating of Carotid, Axillary, and Gluteal Aneurism.

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* I do not, of course, mean that the operations are equally severe; but that about the same number of patients die after each. This is probably to be accounted for by the state of the circulating system and of the constitution which gives rise to aneurism.

† In one case the whole hand was inserted up to the wrist.

THE HUNTERIAN OPERATION BY LIGATURE.

he treatment of popliteal aneurism by ligature is one, and haps the most perfect, of the many discoveries of modern geons.† It reduced a disease, which before was almost formly fatal, to the position of one of the most manageable ll serious surgical affections. It is true that in still more ent times a method has been discovered which is usually cessful at even less risk to life; but this method of comssion, though, as we shall see, it may commonly be reckoned on in popliteal aneurism, may fail even there, and there are ny arteries to which it is inapplicable; so that the Hunterian eration of tying the artery above the sac still is, and probably ll long remain, the last resource of surgeons in the graver ses of aneurism. Of so great a discovery and so happy a iumph of our art over difficulties which we, who have been ught how to combat them successfully, cannot estimate in eir full magnitude, the history is always interesting, and the ght appreciation of the claims of rival inventors is a matter of o slight importance. Unfortunately the limits of the present ork do not allow of an adequate discussion of this subject, so hat all that can be said about it must be comprised in a very ew words, and it is more with a view of avoiding ambiguity or ifficulty in reading foreign books, than of writing a portion of the History of Surgery, a task which is not attempted in the present work, that the following brief account is inserted of the rival claims of Hunter and Anel to the honour of giving his

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* A good description by Mr. Erichsen of this operation will be found in the *Lancet*, 1868, vol. ii. p. 504.

† It is not intended to assert that the practice of tying arteries is a modern invention. ‘The Greek and Arabian physicians,’ says Mr. Hodgson (op. cit. p. 187), ‘more especially Ætius and Paulus of Ægina, distinctly recommended the ligature of the brachial artery a few fingers' breadth below the axilla for the cure of aneurism at the bend of the arm.’ But, like many surgical inventions of the ancients, it had been lost until its reintroduction by modern surgeons in a more complete and more practicable shape.

name to the operation now in use. This operation consists in securing the artery by a single ligature at a distance from the sac, and between it and the heart. The student will always bear in mind in reading most of the modern French works on surgery, that they intend by the 'méthode d'Anel' the same thing as English, German, Italian, and American writers do by 'the Hunterian operation.' The essential difference between Hunter's and Anel's methods has been shown so often and so clearly, that although I think it necessary again to expose it in this place, this will be done only cursorily, and as little space as possible will be wasted upon a question which has become rather personal than scientific.

The old method of operating for aneurism has been discussed, and its radical error has been seen to be, that its authors confounded what is in reality the effort of nature for the cure of the disease, viz. the deposit of laminated fibrin with the essence of the malady itself; and instead of striving to encourage and promote this deposit, thought it necessary to undertake a severe operation for the purpose of removing all such clots from the system. Another, and hardly less fatal objection to its general application, was, that as the old surgeons never contemplated the possibility of a cure of the aneurism without the entire suspension of the circulation, it was necessary, in their view, to tie the artery close above the tumour, and, this having been done, it was found out that the blood would usually escape from the lower end unless that was also tied.* The great merit of Hunter consists in his having avoided both these errors; in his having seen, *first*, that it was not necessary to turn the clots out of the aneurismal tumour, so that no incision was required to open the latter; and *second*, that it was not necessary to stop the circulation through it absolutely, but only, as he said, 'to take off the force of the circulation,' so that the artery might be taken up some distance from the sac, and therefore at a part where it would probably be found healthy; and further, in his perceiving that the ligature of the main artery of the limb does not involve the gangrene of the extremity, but that the anastomosing vessels may be trusted to carry on the circulation.†

From these considerations Hunter was led to propose the ligature of the artery at a point some distance above the sac for the cure of aneurism, the result of disease; and that he, at any rate, and his contemporaries thought that he was making a proposition of startling originality, is clear from the terms in which Hunter cautiously recommended it in his lectures, and from those in which Bromfield commented upon what appeared to him its rashness and its dangers.‡ That it was equally new to Anel's countrymen (although seventy-five years had elapsed since Anel's day, during which the operation d by him might have been expected, had it rested upon any new ple, to revolutionise surgery), is equally clear from a perusal of the nt work of Roux.* We read there, that while in England the great l of Hunter, and in Italy, Paletta, Vacca, and Scarpa, had everywhere d abroad the use of the Hunterian operation, the old method was gaining d more and more firmly in France, until M. Roux himself, after his n from England, reimported Hunter's operation, which, as we shall see, een performed once by Desault. In fact, he says that it was not without ishment that the Paris surgeons heard of a practitioner at Angers having ash enough to apply Hunter's method to a *traumatic aneurism in the bend e elbow*; the very case on which Anel had operated. So utterly had the ory of this reputed discovery perished with its author. It may, however, plied that, though Anel's operation failed to attract the same notice as er's, this does not prove that they are not identical in principle; nor does Even if it were so, however, there would be no little injustice in passing ly over the merits of the man who excogitated the principle by profound ning, applied it in spite of searching hostile criticism, explained clearly heory on which it rested, and succeeded thus in forcing the world's attention imitation in favour of one who was quite ignorant of the true principles hich the cure of the disease must be founded, and who, for anything that ars to the contrary, was guided by pure chance to the selection, on perfectly principles, of an operation which he never repeated, nor persuaded others peat. This would be so, had Anel even happened to stumble on the same ation as Hunter; but the truth is, that the operations are perfectly ent,† and rest on different principles; and that while the one will ably succeed, the other will almost certainly fail in many cases where the rism is the result of disease.

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* But some of the old operators used, as we have seen, one ligature only (p. 456, note). This fact should not be forgotten, as bearing on Anel's claim to originality in his invention.

† This had, however, been previously taught by Haller (quoted in Scarpa, Wishart's trans. p. 229).

‡ See Hunter's *Works*, vol. i. pp. 547 et seq.

e case on which Anel operated has been often quoted, and is very well n. It need not here be related at length. The facts were these: a man received a wound of the brachial artery in venesection. It is said that a ight afterwards an aneurism formed, and the wound reopened and gave to hæmorrhage, which was arrested by compression; and that after this, tumour became very voluminous. What length of time had elapsed, and t the state of the tumour was, when Anel undertook his operation, we are informed. The operation consisted in exposing the brachial artery, tying s near the tumour as possible, and applying 'the proper dressing and

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Quarante Années, &c. vol. ii. p. 89.

No better proof of the radical difference between the two operations can equired than is furnished by comparing two consecutive pages of a writer persists in calling Hunter's method the 'méthode d'Anel;' see pp. 509, 510 M. Broca's work. In the former page he is carefully and judiciously laining the essential difference in their effect on the collateral circulation, . hence on the patient's chance of recovery; in the second (the passage mencing 'étudions maintenant'), he has recurred to his habitual language, speaks of them both under one common designation. To such an extent is pedantry of error carried, that it is difficult at first to see that in the latter sage the common or Hunterian operation is spoken of under the name éthode d'Anel;' while in the former the same term signifies the now disused ceeding which that surgeon adopted.

bandage.' We are not told expressly whether the blood in the sac was still or fluid; but it appears clear that it was in the latter state, and that the only reason which Anel had for not opening the sac, and emptying it of its contents, was that he was able to empty it by pressure. That this was so, appears implied in his own observations on the subject. He says: 'Instead of tying the artery above and below the tumour, I only tied it above; and besides, instead of opening the sac, I did not meddle with it; not doubting that the blood which it contained would disappear, having the opportunity of passing towards the extremity of the limb, and that the sac once emptied would not fill again, but its tissues shrivel up, and the tumour thus disappear; and all this occurred as I expected.' It seems clear, then, that if Anel expected the blood in the sac to pass on towards the hand, that blood must have been fluid, and probably the 'suitable dressing and bandage,' which he says he applied after the operation, may have had quite as much to do with the cure as the ligature of the artery; and, after all, the case may have been cured by direct pressure, an event not uncommon in recent traumatic aneurisms at the bend of the elbow. This is evidently quite a different operation from Hunter's, the only principle it has in common with his, is that of leaving the sac unopened; and few persons who read without prejudice Anel's confused and obscure account of his operation, will fail to see that the reason of his not meddling with the sac was most probably that it could be emptied by pressure. This view is again supported by the fact that Heister, who followed Anel's account and apparently spoke on the authority of his single case,* advised its application only in 'reducible' aneurisms. Thus it does not appear that there was much of novelty in Anel's method, since it merely consisted in leaving the fluid contents of the tumour an exit by the lower end of the artery instead of tying the latter, just as Keyslère had done; and it may very fairly be doubted whether what novelty there was, was not a mistake,† and whether Anel's cure, in spite of its success, is not only another instance of haphazard good fortune. At any rate, the results which flowed from it before the time of Hunter do not seem to testify to the brilliancy of the discovery. The great learning and evident bias of M. Broca have only enabled him to adduce what he calls six instances of operations performed on this plan before the date of Hunter's operation, a period of seventy-five years. Two of these are related in the loosest way by Bertrandi, as having occurred in the practice of some anonymous surgeon, and were failures. Of the others, one was of the temporal artery, and two others of the humeral, all most probably traumatic, and all very likely curable without difficulty by very simple means. The sixth case is the celebrated operation of Desault. It would be impossible, without taking too much space from more important matter, to discuss this operation fully in its bearings upon the Hunterian method. It is sufficient to say, that it was performed on a case of popliteal aneurism of small size, strictly after the method of Anel, *i.e.* by tying the artery immediately on its entering the sac. It appears (notwithstanding what has been said to the contrary) to have been successful, at least in its immediate results: the ligature separated at teenth day; the tumour burst and discharged its contents on the day wing; this wound healed, and the tumour disappeared. The patient died months afterwards of a disease of the tibia, which appears to have totally unconnected with the operation. This, then, was precisely the as Anel's operation, and therefore missed the second and third principles * trated by the method of Hunter; viz. that the artery may be tied at such tance as still to allow circulation through the tumour, and that the previous ease of collateral branches is not necessary to avoid gangrene, and that efore the artery may be tied at the most convenient spot.†

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* Heister, *Instit. chirurg.* pars ii. sec. i. ch. xiii. § 20, Amstelod. quoted by Broca, p. 446.

† It seems as if Anel expected that the sac would empty itself, and not again be filled; being ignorant of the reflux current and of the coagulation.

The practical objections to Anel's method may be thus med up. It leaves no current through the aneurism except slight and weak reflux flow from the artery below. Con- uently the clot formed will most likely be soft and loose, and e tumour will suppurate. It places under the ligature a part

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* See p. 462.

† It would be unjust to deny the merit of Desault in applying the almost gotten method of Anel to the treatment of that most formidable affection it then was), popliteal aneurism, and still more unjust to deny that the erience thence acquired might possibly, had he survived, and had Hunter been in existence (in fact had all the circumstances been altered), have ducted him to Hunter's discovery; but it is monstrous to set up Desault, as Broca wishes to do, as the rival of Hunter, when, according to his own wing, Desault himself was quite content to pass as Hunter's scholar. 'With elf-abnegation,' as M. Broca amusingly says, 'which his English detractors ve been unable to appreciate, this great surgeon, who then had become quainted with the operation practised by Hunter, did not hesitate to adopt precepts taught by his illustrious rival' (p. 454). Desault, in fact, was aware of his title to the glory which M. Broca claims for him. As to the inuation which M. Broca ventures to make, that Hunter was indebted for operation to Desault by means of Assalini, who, according to him, was sent at Desault's operation, and related its details to Hunter shortly after- rds in England, it refutes itself. The Hunterian operation was taken up where more warmly than among the eminent Italians who were proud of ing of the Hunterian school, as we have seen above from the contemporary count of M. Roux. Had one of their number conveyed to Hunter from Paris the first idea of the operation for aneurism, we may be quite sure that he, or some of his compatriots, would have said so. Assalini, an Italian surgeon, was the only person present, as far as we know, both at Desault's operation and at the first operation of Hunter. It was mainly through Assalini that the new method of treating aneurism was brought into vogue in Italy. Assalini and all other Italians always speak of that method as Hunter's. Would this have been so, had Assalini taught it to Hunter from what he had himself learnt of Desault? But the fact seems to be, that Desault's operation, which was not brilliantly successful, and which he did not put forth as original, attracted little attention from himself or anybody else; and that he had no desire, as he had certainly no right, to claim any priority over Hunter, whose teaching he, on the contrary, followed with great intelligence and great success in the single operation which he had subsequently an opportunity of practising.

was feasible, the old operation would be eq
and more certain of success.

The foregoing observations will, it is hope
the use in the context of the name of Hunter
operation which he is not denied to have inv
in which alone it is now practised, to have fi
to have afterwards, in spite of much oppositio
general favour. If these things do not give
tion, it is hard to see how such an honour is

The Hunterian operation consists in ty
which the aneurism is situated at any co
above the sac. The operation, as it is now p
many important particulars from that whic
perform; particulars which have a most mate
its success, and which were impressed upo
and upon his scholars and successors, by th
perience. Thus, Hunter used to tie the fem
lower part (in the fibrous sheath, called from
'Hunter's canal'), an operation much more di
ous than the modification introduced by Sca
his first operation, brought a large part of the
into contact by four broad ligatures, somewh
conceiving this disposition to be more favour
of the artery, which he described as taking
cess of 'first intention.' His own experien
taught him to modify his form of ligature, a
string; and the more extended experience a
successors (among whom Dr. Jones‡ has d

st place) have proved to demonstration, that the best form ature is a single stout thread, drawn tightly: accordingly her form is any longer in general use.* Lastly, Hunter ot at first at all careful to avoid including the vein with rtery in the ligature; but this was an error which he

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dans le traitement des anévrismes,' Paris, 1834; South's *Chelius*, vol. ii. ; Porta, *Delle Alterazioni patologiche delle Arterie*, &c., Milano, 1845.

the *American Journal of the Medical Sciences*, Oct. 1859, p. 570, will d a very interesting case, in which Dr. Warren Stone, of Louisiana, tied mmon iliac artery with a silver ligature. The ligature was not drawn nough to cut through the internal coats of the artery, according to ne's judgment; the ends were cut short and turned down, and so left. tient died, apparently of causes unconnected with the operation, on the -sixth day; but the symptoms after the operation are not fully given. gature, however, seems to have fulfilled its purpose. The body unfor- ly was not examined, so that the condition of the ligature was not ined. It seems to have been intended by Dr. Stone to remain on the permanently, without exciting any ulceration, and therefore without g risk of secondary hæmorrhage. That this will sometimes, at any e the case, appears by an instance in which I tied the femoral artery for m after the failure of compression. The artery was enclosed by a silver rawn just tight enough to arrest the pulsation of the tumour, then twisted and cut off short. The wound did not unite by first intention, e suppuration which took place beneath it was transient; the ligature came away, and the man left his bed on the fifteenth day after the opera- he wound having been healed several days before. But if the ligature be too tight it will cut the coats of the artery more than a silk thread do, and I have seen a case in which secondary hæmorrhage rapidly ed the application of a silver ligature. Hence great care is required, in such ligatures, not to employ too much force.

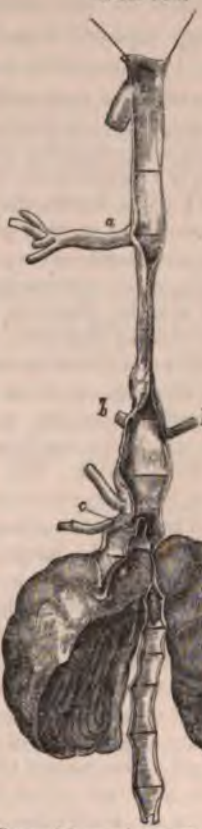
fessor Lister has recently introduced into practice the method of tying s with catgut steeped in carbolic acid—'the antiseptic ligature,' as he t. Sufficient experience has hardly yet been obtained of this method to an opinion concerning it. In a case under Mr. Spencer's care, where a re of this kind was under the carotid artery, it was said to have un- d—though as to this there was some dispute. In a case of amputation my own care, the popliteal artery was tied with this form of ligature. condary hæmorrhage took place. The patient (who was in very bad at the time of operation), died seven days after the operation. I found the re perfectly loose; the lips of the cut end of the artery were in apposition, here was very little coagulum in the vessel. Similar ligatures have, er, been used in many other cases with perfect success. I need hardly to the many times in which animal matter has been used experimentally g vessels. I should perhaps mention, that in one case where Mr. Lister ed an artery with this catgut, he believed that he found the materials of gature several months afterwards in process of organic connection with rts around.

withdrawal or diminution of the force o preponderance of the heart being abated, taneous cure commences. The ligature ac as Valsalva's method acts; that is to sa force with which the blood distends the opportunity for the coagulability of the blo of the parts to fill the sac with firm laminat the cure of the disease. It differs, howe method in this important particular—tha instead of general, and is therefore incomp and more safe. As the process by which t and the changes which it afterwards unde extent the same after ligature as in the nat the reader is referred on that head to what But to that account it must be added, tha ing parts are suddenly relieved from tensio of the expansive force of the aneurism, the compression they exercise upon the tumou important part in the cure after ligature taneous cure.

While the aneurism is becoming consoli circulation is enlarging, to convey the b below the ligature. The meaning of this when an artery has been tied at any gi considerable branch which leaves it abo operation, and in their degree the branche

changes of volume is well known.* Thus a ready way
l for the blood to return into the parent trunk below
of ligature. To make this clear by an example: say
femoral has been tied (as it generally is) some distance
ie origin of the profunda, in
of popliteal aneurism. The
ll distend the profunda artery
ranches, amongst others the
circumflex and its descend-
ch; which, joining with the
external articular, and thus
anastomotica magna, will be
the arteries to convey the
und the ligature back into
k of the femoral, below the
ed spot. The number of
lateral arches of anastomosis
tain, but probably they are
is in most cases, and include,
ned arteries only, like that
dduced as an example; but
er of muscular and other
s, the anastomoses of which
ne in the healthy state, that
ape our ordinary methods of

Fig. 160.



Cure of femoral aneurism by ligature of the external iliac. The artery is seen to be obliterated for some distance at the seat of ligature: *a*, *b b* show the enlarged collaterals on either side of the ligatured portion. The artery is again obliterated for a short distance near the aneurism; *c* points to enlarged collaterals, one of them of very large size, probably the profunda. The artery is seen to resume almost its natural size just below the aneurism. (From a preparation in St. George's Hospital Museum, ser. vi. No. 120.)

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nlargement of the collateral vessels
nd upon the presence of some oxygen
od, as well as the sufficiency of the
o of the heart. If the former be
ere is no attraction of blood to the
in the distant part of the limb;
al asphyxia, followed by gangrene,
ue. Deficient vis a tergo would
by pallor and coldness, with shrink-
distal parts; a defective capillary
with sufficient vis a tergo, would
in a stationary venous condition,
vid congestion of the limb; while
and the attraction be both wanting,
nust be simply cold and inactive—
ing. The integrity of the walls of
mosing vessels is also an important
in the restoration of the collateral
l.

* The number of anastomosing branches varies consi
figures a preparation in which he found between fifty a
hand, there is a preparation in the Museum of St. Thor
the blood is brought down from the upper to the low
artery by a single branch the size of a crow-quill. S
probably referring to this preparation, as well as to
thigh he amputated some years after an operation
that although the anastomosing vessels which enlarge
operation may be numerous, their number afterward
necessary yielding their place, as it were, to a few, or pe
which may be found nearly in the place and nearly of
trunk. (Wardrop, op. cit. p. 12; see also *Med.-Chir.*
Two beautiful plates, the back and front view of a p
collateral circulation has been injected after ligature
seen in Porta's work. The very free communication
circumflex, superior external articular, and anastomotic
shown. There is also a large and direct arch of an
latter artery and the internal circumflex. Thus the
above the aneurism have been kept pervious, while
blood enters the popliteal by two great branches (in
receive their supply from a large arterial network in fro
from the arteries above mentioned (viz. profunda, anasto
circumflex, and superior articular): a direct communic
to the tibial recurrent appears also to have reinforced th

† See the experiments of M. Broca, op. cit. p. 50
ligature under the femoral artery of a dog in the groi
leg at the knee, and noted the distance to which the
both during the systole and diastole of the heart. T
was then tightened, by which, of course, the bleedin
time; but it recommenced from the popliteal artery at
and at the end of five minutes the jet (which, howev

of vessels is very far more active than in men, so that gangrene never follows on the ligature of arteries. No onclusions, therefore, can be drawn from this experience. , however, the process seems to advance sometimes very in the upper extremity, where the natural anastomoses . Thus, in Anel's celebrated case, it is stated that the ould be felt at the wrist on the day after the ligature of chial. In Mayo's case of ligature of the subclavian,* the as felt at the wrist on the fifth day, but disappeared rds; and in a case of popliteal aneurism operated on by mps, pulsation was, it is said, felt in the sac seven hours e operation.† On the other hand, in a case where the writer had occasion to tie the axillary artery during an on, the patient being a child, no pulse was perceptible in ial more than a year afterwards. The enlargement of aterals has taken place to some extent before the operamost, if not all, cases of aneurism, being occasioned by stacle to the circulation caused by the aneurismal . The readiness of the return of pulsation will depend at measure upon the agents by which the circulation is

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with more than two inches of each vessel. The precise time between upper end of the artery and opening the lower is not given, but have been many minutes. The patient recovered perfectly. In this 'rofessor Weber remarks, the collateral circulation had been doubtless by the pressure of the tumour on the main trunk.

-*Chir. Trans.* vol. xvi. p. 363.

drop remarks on this head: 'The enlargement of the anastomosing a certain extent, takes place almost instantly after the trunk has . I observed this in a child in whom I had secured the carotid could see the branches of the temporal and occipital underneath the ntegument enlarging, and thus actively acquiring great additional mediately after the operation.' (*On Aneurism*, p. 12.) As to the time the process is completed, the following is extracted from Porta, op. : 'It is difficult to determine the time of the restoration of the circulation after the ligature, inasmuch as it varies in different cases. s, after two or three months, the anastomotic circulation is so full, ems at the height of its development; while in other cases, six or nths afterwards (always compared with the healthy limb) it may be hardly matured. From my observations, I am led to believe that eral circulation is developed in a limb operated on in the space of a ths, and generally before the end of the first year; because, on specimens at remoter epochs, after 12, 18, 24, 36 months, it is not t the anastomotic system has progressed farther. This system is fully d at that time when it has attained the aim of its development, as ht up the circulation to the measure of the requirements of the brought to a standstill.'

in a few days at the latest, either gangrene
circulation will be so far re-established that
through the artery, entering it by the bra
below the ligature, and probably by many
branches. Thus, when the ligature has bee
from the disease, the blood returns into th
aneurism; and so, if the tumour be not alre
the circulation through it may be re-establis
tion is sometimes sufficient to prevent coag
petuate the disease; and failures from this
ally, but rarely, noted. More commonly,
circulation is sufficient to cause a sort of un
to become perceptible in the contents of the
after the ligature; but coagulation is ac
rapidly suppress this movement, which soo
preciable. Now in these successful cases t
dition of parts may be twofold. If the ar
form one channel, or if the aneurism stand
the artery, the canal of the vessel may be
the circulation will be carried on through it
majority of aneurisms, which are neither fi
culated, but sessile, and involving more or
ference of the vessel, the obliteration of th
that of the affected artery; and now anoth
mosis will often be required. The necessit
[illegible]

en the point of ligature and the aneurism, and on the er of branches which communicate with the main between them. If the point of ligature be distant, as in ommon operation for popliteal aneurism, or if many hes intervene, the artery will be pervious between the re and the tumour (Fig. 160), and therefore two sets of erals must be developed; one to carry the blood round the f ligature, the other round the aneurism. There is no nce to prove that this double call upon the powers of nature ises an unfavourable influence on the prospects of the tion, although it is quite possible that it may do so. Thus, of the cases of suppuration in the sac after ligature, such ose quoted on pp. 447, 448, may be due to imperfect dement of collaterals round the aneurism, and the consequent stence of the circulation through the tumour, which ought temporary only. It is probable, however, that the very of the existence of an aneurism exerts in most cases a ding influence on the circulation through the trunk of the l, and thus induces a preliminary expansion of the ches immediately above it, so that the lower arch of anassis may be more easily formed than the upper; or the r may take the place of both, the collaterals above the ure communicating with the branches of the artery beyond neurism, as would be the case in an aneurism seated on the non carotid, where no branches intervene between the ure and the tumour, and usually in the external iliac. In cases, dissection after a successful operation will show the y obliterated at the seat of ligature and at that of the rism, and pervious between them.*

e immediate effect of a ligature applied to a main trunk is urse to suspend for the time the supply of blood and the tergo of the heart. Hence congestion of the blood in the emity, and hence temporary rise of temperature.† Another

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For a collection of several cases in which the femoral artery was found per- between the ligature and the aneurism, see Wishart's *Scarpa*, pp. 263–4.

See Dr. J. R. Wood's case, in 'Report of Surgical Practice of Belle Vue ital,' *N. Y. Journ. of Med.* 1858, p. 239; and Sir. W. Lawrence's, in *Med.- Trans.* vol. vi. p. 206. It will be remarked in the latter case, one of ure of the external iliac, that though the ham on the affected side was er than on the sound side, the foot was always colder. It is interesting serve that in experiments on animals this rise of temperature does not place, the activity of the collateral circulation preventing even temporary stion (see Broca, p. 507).

had received a severe injury to the spine.
although the immediate paralysis may pa
effects will persist, and a partial loss of mot
be permanent. Still more often the nutri
impaired, so that the member is thinner,
than the other. This I have myself noti
the child above referred to, in whom the
been tied. When she was last seen (more tl
operation), the arm, although it was the r
smaller and weaker than the other. Thus
accidental exposure to cold, may occur lon
toes in cases where the femoral artery has b
no symptom of gangrene has followed immed
tion.† These unfavourable consequences
sight of in determining the question of ligat
They depend in all probability on a defective
in size or number, of the collaterals, by whi
the parts is diminished, the conducting pro
probably suspended, and the irritability of th
Mr. Liston thought that the excessive deve
mosing branches running in the substance
the comes nervi ischiatici, might produce par
improbable, but receives a certain amount of

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[*] But sometimes slight and transient paralysis of

d by Porta, and from some observations which he has made it.*

uses of death after ligature.—The chief dangers following peration are from gangrene and secondary hæmorrhage,†

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e Porta, op. cit. p. 381.

the *American Journal of Medical Science*, new series, vols. x. xiii. xiv. d. are some excellent statistical papers upon the ligature of the principal a, viz. the subclavian, carotid, femoral, external, internal, and common showing the proportion and causes of death in each operation. The papers are from the pen of Dr. Norris; the last is by Dr. Stephen Smith. ey display an amount of mortality after these operations which is ly not generally known, it may be as well to quote all these statistics r.

Ligature of	No. of cases collected.	No. of deaths	Per cent.
Subclavian	69	33	47·8
Carotid	149	54	36·2
Femoral	204	50	24·5
External iliac	118	33	27·9
Internal iliac	7	3	42·8
Common iliac	32	25	78·1
Total	579	198	33·1

Pilz's and Dr. Cutter's more recent and fuller statistics of the ligature carotid and external iliac arteries, which will be referred to hereafter, e mortality after those operations still higher.

e reader will compare these returns with the most complete statistics o obtained of the mortality after other surgical operations, as those of tion by Mr. Bryant in *Med.-Chir Trans.* vol. xlii., he will at once see e ligature of the main artery of a limb involves the gravest dangers, an operation which should only be undertaken in the face of evident ty. The above returns might have been made still more unfavourable ecting the cases of ligature of the two largest arteries—the aorta and nate; but it was thought better not to include operations which many consider unjustifiable, and which will probably be soon banished from l practice.

omparing Mr. Bryant's statistics of amputation, it will be seen that the e even of the femoral artery, the lowest in this list, is almost as fatal as y amputation of the thigh (which appears in those statistics as being 27·27 per cent. of cases), while most of the others approach the ty of the greater primary amputations.

e considerations show strongly the propriety of avoiding ligature of a tery whenever there is any prospect of curing the disease by any other . The table in Porta's work (p. 404) gives a similar conclusion. It a synopsis of 600 cases, and might perhaps have been expected to be at more favourable than the above statistics; as, although it includes of ligature of the aorta and innominate (which were uniformly fatal), gangrene is, as we have seen, unknown. grene are, a deficiency in number or in ext lateral branches, or a want of due care temperature of the part after the operati limb with bandages, or, finally, some inju cipal vein of the limb during the operati

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it also comprises 68 of ligature of the brachial, an op successful. Still the deaths are 167, or more than show a much more favourable average in any operati the subclavian and common carotid. The difference, statistics of these operations and those of Norris d merely on some of the published fatal cases having esc The real averages are probably more unfavourable ; fa unpublished. At least this conclusion is supported the nature of published cases, and by the experienc the ligature of arteries, as shown in the statistics o *Gazette*, which will be again referred to.

[*] Of the fifty fatal cases of ligature of the fe table, twenty-three are stated to have died of gan hæmorrhage.

[†] That gangrene is often due to injury of the vei Syme has strongly insisted on (*Principles of Surger* appears to go so far as to allege this as the only cause the received opinion (which has just been stated a gangrene may occur when no injury has been done numerous facts. Amongst others, a preparation exis George's Hospital, with a record of a careful dissec in which the vein was clearly proved to be perfect

ne to obviate the first cause of failure. It may be suspected, persons of weak circulation and exhausted by old age or ess, that in the former case their arteries may possibly not astomose very freely, while the latter class are nearly sure to our under an atheromatous condition of the vessels. Hence h are bad subjects for the ligature of an important artery; t as these operations are now never performed unless under cumstances of urgency, in which all risks must be run, a owledge of the state of the arteries, even if it could be cerly attained, would, after all, only affect prognosis. Much y, however, be done to prevent gangrene by maintaining the perature of the part. It would seem at first sight incontent to talk of the necessity of keeping up the temperature in extremity in which, as we have seen, it has already risen ove the standard of health. But this contradiction is only parent. The temperature of the toes rises after ligature of e femoral artery, not from increased power in the part, increased vital activity, in which case it would clearly be ong to add fuel to the fire, but from diminution of the vis a go of the heart, and consequent stagnation of the blood in e extreme vessels. Expose the part to cold—the tissues will ntract upon and unload the vessels, which will themselves so be constricted by the cold—and the part will not only be prived of blood, but a powerful obstacle will be offered to the eakened circulation by the rigid and contracted state of the essels and the parts which support them; an obstacle which ost probably will be found insurmountable. Hence the importance of maintaining the limb as near the natural temperature of the body as possible. It should not be much warmer, ince parts in which the circulation is imperfect are as little ble to resist heat as cold: thus gangrene has followed the application of hot salt or sand-bags to the limb. The best application is carded wool, which merely retains the natural warmth, and has the additional merit of retaining it without requiring renewal, while it allows the occasional inspection of the limb if required. It is advisable, however, to make such inspection only rarely, since it cannot be done without some change of temperature, which, if often repeated, might have a

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Carmichael and others have spoken of the occurrence of phlebitis and obliteration of the vein, sometimes followed by gangrene, as a consequence of injury to the vein (see Broca, p. 479).

prejudicial effect. The wool should be used in large quantity, so as to form a thick layer around the whole limb, nearly as high as the seat of operation, and secured by a bandage loosely twisted round. It will be understood that the limb should be kept in such a position as to facilitate the return of blood.*

The patient's diet and regimen should not be too rigid. This will of course be regulated by his previous habits; and the same may be said of the exhibition of opium. In persons of dissipated lives and nervous temperaments, stimulants and moderate quantities of opium must be allowed; while robust persons, with equable and tolerably strong pulse (who, however, are rarely the subjects of aneurism), will do better on a nourishing but unstimulating diet.

When gangrene has once declared itself, which usually occurs on the second to the fourth day,† the case becomes grave; but the prognosis is not hopeless.‡ All depends on the rapidity with which the mortification advances. If, as is sometimes the case, it shows itself, not merely in the ends of the toes, but simultaneously on the dorsum of the foot, and advances with rapidity, no time should be lost in amputating, and the limb should be removed as near the seat of ligature as may be found convenient. It is not absolutely necessary to operate at, or above, the place where the artery has been tied. The portion of the limb just below this spot is nourished, not from the obliterated part of the vessel, but by the branches of a higher origin, so that there is no fear of sloughing of the stump.

When the gangrene, on the contrary, appears only in a limited space, and extends slowly in the continuity of the limb, hope may rationally be entertained of preserving the member. The case must be treated like any other case of gangrene, by local warmth, local and general stimulants, and opium, with due regard to the patient's constitution, nervous temperament, and general symptoms. I venture to think that the attempt to preserve limbs after gangrene the result of ligature is not rally speaking, carried far enough. The prognosis of am-tion in these circumstances is not very favourable; the cases ely resembling those of secondary amputation—the most l, according to Mr. Bryant,[*] of all classes of amputation.[†] puration and sloughing of the sac is a kind of gangrene, and ne of the chief causes of death after ligature. It sometimes es rise to hæmorrhage; but more frequently it poisons the d, and leads to death either by pyæmia, or by that systemic ction of which pyæmia is the local manifestation.

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* Mr. Guthrie's favourite method for obviating gangrene was to have the limb constantly chafed by the attendants.

† Although sometimes not till the second or third week (Porta, op. cit. p. 393). In Dr. Hargrave's case of ligature of the common iliac artery (Dubl. 1865), gangrene did not show itself till the thirty-first day, and was hardly stopped when the patient died on the seventy-third day.

‡ The mortality of gangrene after ligature of the femoral artery is estimated by Porta at 71 per cent.

he other cause of death, that from secondary hæmorrhage, been already treated of in the essay on INJURIES OF THE SELS, vol. i. p. 738.[‡] It is more common in the upper remity, where the heart is near, the circulation powerful, and processes more rapid, than in the lower. It is also more to pprehended after ligature for aneurism, when the artery is re likely to be diseased at the point operated on, than for nd, when it will, in all probability, be healthy.

esides these causes of death after ligature, the operation etimes fails to cure the aneurism, though the patient vives. This, indeed, is rare; but it seems to occur in two ys. Either the pulsation never disappears in the tumour, and latter, perhaps after a temporary check, continues growing size, and will ultimately burst; or the aneurism diminishes, omes solid, and undergoes a process of apparent cure, but n, after a longer or shorter period of quiescence, the pulsation ppears, sometimes with a sudden increase in size, and the ease is said to recur.

When the ligature fails to abolish the pulsation, this depends in on one of two causes. The artery may have connected h it a 'vas aberrans,' by which the blood is brought directly m into the tumour. Such was the state of parts in Sir C. l's case of ligature of the femoral artery.[§] This condition of vessels, however, will not escape the attention of a careful l well-instructed operator; and the fact that tightening the ture has not its usual effect on the pulsation of the aneurism, l show that the latter must either be seated on some other sel, or, at any rate, must communicate as freely with another

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Med.-Chir. Trans. vol. xlii.

Of forty-nine cases of gangrene after ligature, fourteen recovered; ten of without, and only four after, amputation (Porta, op. cit. p. 394).

See also the sections on ligature of individual arteries.

London Medical and Physical Journal, vol. lvi. p. 134.

vessel as with the one tied. Accordingly this other vesse
be sought for by careful dissection; and until it is foun
original ligature is not to be tightened. If there be
aberrans, the other vessel will be at no great distanc
should be tied at once. When this has been done, if pul
is quite abolished in the aneurism, it will perhaps be unnec
to tie the vessel first exposed; but it will be more prud
leave the ligature (which has been already passed) under
be tied on the first symptom of returning pulsation i
tumour. These anatomical anomalies are so rare as
merely surgical curiosities; still they should be borne in
It more frequently occurs that the circulation throu
aneurism, temporarily abolished by the ligature, returns i
hours or days, and continues to increase till it reac
previous force, and the disease runs its course app
unaffected by the operation.* This accident must be du
preternatural activity of the collateral circulation; and i
which it is difficult to meet with appropriate treatment.
first place, it seems reasonable that nothing should b
until the limb appears beyond the risk of gangrene, an
the pulsation is plainly permanent; and this cannot be
be the case until the tumour has been pulsating very di
for some months, and the pulsation shows no tendency t

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* The *temporary* return of pulsation is not so uncommon. Porta re
this head: 'Out of 448 cases of aneurism and aneurismal varix cure
Hunterian operation, there was in twenty-five cases a relapse; that is
manifest reappearance of pulsation in the tumour; but the pulsa
temporary, lasting from a few weeks to some months, and then disa
The case, however, above related of Miloni, and the two published ca
the care of Cooper and Roux, show that even in the thigh the an
may enlarge to such a point as to annul the action of the ligature. S
are fortunately most rare. Relapse would occur much more frequent
neck and elbow, where the anastomoses are naturally so ample and dir
it not that the aneurism, however small, already contains some clot;
blood, directly on the application of the ligature, being reduced for s
to the minimum of movement in the trunk operated on, ceases du
time to feed the tumour and the aneurismal artery, so allowing the ob
of both by fresh clot' (op. cit. p. 385). The three cases referred t
found in Porta, p. 378; *Brit. and For. Med. Rev.* vol. vi. p. 67; *B*
Bologna, an. xiii. series 2, vol. xi. p. 185. Another case, which illust
return of circulation after ligature, occurred in Mr. Stanley's practice.
the posterior tibial artery low down in the leg for wound, using two
at some distance from the opening. Hæmorrhage continued; and
to place other threads closer to the hole in the artery (Ormerod,
Collections, p. 151).

hould always be borne in mind that a slight undulatory pul- on in an aneurism on the second or third day after ligature s very usual phenomenon, and so far from being of evil ury, is considered by many authors to be a favourable sign, ering it more probable that laminated clot will form. It is med that, previous to the original operation, compression of artery above the tumour has either been tried and failed, was contra-indicated. Hence it will be probably useless recur to that method. Direct pressure, or genuflexion or ible flexion of the elbow, if the aneurism be in the forearm, h appropriate bandaging of the limb, will of course be tried. en these measures fail, two courses are open—either to tie artery lower down, between the ligature and the aneurism, o perform the old operation of opening the sac and tying the ry as it enters and leaves it. As a general rule, the former thod will be preferable in the lower extremity, the latter in upper. Or if the surgeon has sufficient confidence in such sures, he may resort to galvano-puncture, or to the injection perchloride of iron (see below the sections which treat of these thods of curing aneurism). The ligature of the main trunk ve the original seat of operation has been tried, but it pears to be contra-indicated both by theory and practice.*

The recurrence of aneurism is, however, usually observed at a er period, after the persistence of the apparent cure for weeks months. This was the case with a patient of Mr. Spence, of inburgh, in whom the aneurism was afterwards cured by nuflexion. The case will be found quoted lower down. It es not appear that the cure was ever a sound one after the ature ; and the pulsation in the aneurism was never abolished, ough on the patient's first discharge it had been reduced to a e which was thought not to be more extensive than that of e popliteal on the other side. Cases such as this fail from e faulty formation of the clot. The sac is filled, not with minated coagulum, but in part, at least, with mere soft clots; d these clots in the course of time soften and yield to the rce of the circulation, or pass into its current. When this s the case, the affair becomes even more grave than when the isease recurs from the causes mentioned in the last paragraph,

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* As to the three cases mentioned in the previous note:—in Sir Astley ooper's case the artery was tied close above the sac successfully: in Porta's se the external iliac was tied; but the patient died of the operation: in Roux's case no treatment seems to have been adopted.

have recourse until he is clearly certain that n
open. When, however, the ligature has certainl
case seems otherwise hopeless, no good can b
delaying amputation.

Such are the causes of failure, and the meth
very uncertain of success, by which they may b
the great majority of cases in which the patie
operation, matters progress quite otherwise. Th
a certain length of time (which varies, generally
ten days and a month, according to the size of
neatness with which it has been separated from co
and the rapidity of vital changes in the patient op
through the artery, and comes away with the d
wound then heals, the divided ends of the artery r
whole of the obliterated portion of the vessel deg
fibrous cord. The tumour, at the same time, co
or less rapidly; the undulating movement, whi
tible in it at first, disappearing as the depositio
coagulum advances, until at length the whole i
and then begins to shrink. Finally, as after th
cure, a small hard tumour remains, like a walnu
into, displays a structure something like that
With the exception of the obliteration of the
two points (for the persistence of circulation thro
aneurism is rare), and the consequent developmen
everything in the limb is natural. In other case
and the faults of nutrition, which always atten
the ligature of the main trunk of a limb, persist

It is indicated whenever the aneurism (which must always pposed to be in an active condition, and advancing, or tening to advance) is situated upon an artery inaccessible essure, but which will allow a ligature to be put round thout excessive danger, and with a sufficient space between art tied and the tumour. Of these conditions the iliac carotid arteries furnish the best examples.

When in an aneurism differently situated, the patient, from ous irritability, drunkenness, or any other cause, is intolerant ore gradual methods, such as pressure, genuflexion, &c.*

When these methods have been tried and failed.

When an aneurism has burst into one of the internal cavities he body, *e.g.* a popliteal aneurism into the knee-joint.

a very interesting example of cure by ligature of the femoral, even after rmidable complication, the reader is referred to a case which occurred at iddlesex Hospital, under the care of Mr. Moore, and which will be found ted in the *British Medical Journal*, 1859, p. 489.

When the rupture has taken place subcutaneously, ampu- on or the ligature is generally indicated; still, in some of the grave cases, it may be possible to obtain a cure by com- ion, but the attempt should not be too long persisted in; le, if the symptoms are urgent, or if gangrene have com- nced, amputation is the only resource.†

Internal aneurism does not absolutely contra-indicate the ration, although it is a most powerful motive for avoiding it less it is believed necessary for the immediate preservation of life. Dr. Crisp (op. cit. p. 189) says that several cas corded where persons with aneurism of the thoracic survived the operation. But, in one celebrated case, t died on the table, from rupture of an internal aneu as the operation was being begun. This accident w probably have been avoided by the quietness and a agitation produced by anæsthesia.

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* Such intolerance must not, however, be too hastily admitted. Almost ry person of ordinary good sense, and even of less than ordinary resolution, y be educated, by the gradual and transient use of digital pressure first, and pressure of instruments afterwards, to bear the amount and duration of pression which is requisite.

† The subject of rupture of aneurism has been referred to above (p. 427). paper by Samuel Cooper in *Med.-Chir. Trans.* vol. xvi., will repay perusal. points out that the pain is not always severe, that the shape of the tumour y be not much altered, and that, beyond a little purple discoloration, no ce of ecchymosis may be noticed. In these cases he is inclined to lay eat stress upon the persistence of bruit, combined with the absence or gradual appearance of pulsation, and a sudden fall in the temperature of the limb. Mr. Poland's paper, in *Guy's Hospital Reports*, 3rd series, vol. vi., contains otes of 42 cases in which the sac of a popliteal aneurism burst, and of the sult of the treatment. In 2 no treatment was adopted: in 1 of these the tumour burst externally, but the patient survived the bleeding and recovered. In 24 compression was used; which succeeded in 2 cases. In 16 the femoral artery was tied: 10 recovered without, and 2 after, amputation; 4 died—3 of gangrene, 1 after amputation on account of suppuration of the sac.

Contra-indications to ligature.—The late Mr. Aston declared that, in his opinion, 'the only circumstance th to deter a surgeon from putting a ligature around any the human body (not excepting the aorta) is, the unifor tion of circulation in the parts below the ligature.'* B regard the preservation of the patient's life as the ultim of all operations, we must surely allow that any pro which is uniformly followed by death is unjustifiable, b ever cause or causes death may have been produced; a more clearly so, if the disease for which the operation h undertaken has been known to be cured by other mea both these objections the operations for securing the ao innominate artery are fairly liable. On the first head, indeed be urged that the number of cases of ligature is insufficient to allow of our asserting that these operati uniformly fatal. This is a point which must be left judgment of those who may be called upon to decide treatment of a case of this nature; but on the secon there is no doubt. Aneurisms at the root of the neck the belly have often yielded to medical treatment or un spontaneous cure, while they have as yet never been c operation, except in one instance of traumatic aneur which the innominate was tied. So that, if ligature be all in these aneurisms, it should only be as a last resor they have burst or are on the point of bursting, or wh are increasing under the best medical treatment which procured.† Again, the ligature should never be applied artery which is so situated as to admit of compression, treatment has been tried and failed, or is contra-indicated me peculiarity in the case. Nor should the ligature be used es of recent traumatic aneurism, particularly when caused cture, without a previous trial of the resources of nature, l by such means as rest, position, careful bandaging, and ure direct and indirect. Such cases, as we shall see, are liarly likely to undergo spontaneous cure. Nor should the ure be used if the heart or a great part of the arterial m is diseased. In such cases digital compression is the t appropriate and safest treatment.

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* *Med.-Chir. Trans.* vol. xiii. p. 8.

† In such a case as the one in which Sir A. Cooper tied the aorta, w the aneurism had opened externally, we may allow that the operation only conceivable means of giving the patient a chance for his life, equally creditable to the boldness and dexterity of the surgeon. objected that the rules laid down in the text would prevent operation root of the neck altogether, since, unless the artery is tied early, it wil of reach—I would reply, that this argument would show the ligature innominate to be an unjustifiable proceeding; for in an early stage of an

Acupressure and Temporary Ligature.

his seems the most appropriate place to notice the proposals ch have been made to treat aneurism by the temporary appli- on of compression to the trunk of the vessel affected. These posals, it is true, have not hitherto come to much; but since J. Simpson's suggestion of acupressure has been so generally pted, compression of the trunk in this way has occasionally n successful, and this has led to a revival in other forms of temporary ligature, which proved unsuccessful in the hands Scarpa, Clive, Sir P. Crampton, and the other surgeons men- ned by Mr. South (*Trans. of Chelius' System of Surgery*, vol. ii. . 218, 222).

successful instance of the application of acupressure to the cure of a small matic aneurism in the ham (probably formed on one of the sural arteries) eferred to by Mr. H. Lee, in the *St. George's Hospital Reports*, vol. iii. p. 33. Cheevers has recorded in the *Boston Med. Journ.* Oct. 17, 1867, a case in ich he applied acupressure successfully to the femoral artery in popliteal urism; but the case was not cured in any shorter time than it would have n by ligature, and the patient seems to have run just as much risk—the ry having been freely exposed, and apparently somewhat roughly handled. rof. Porter treated a case of subclavian aneurism unsuccessfully by acupres- of the axillary on the distal side of the tumour. The man died not very afterwards, and the vessel was found not completely occluded, but narrowed. *ublin Quarterly Journal*, Nov. 1867.

Numerous contrivances for the temporary occlusion of divided exposed arteries have been introduced.

ne of the neatest appears to be that recommended by Dr. G. H. Porter,* which

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he root of the neck, the patient has some chance of spontaneous cure, and a d chance of surviving a tolerably long period, while after the operation his will, in all probability, be reckoned by hours.

Dublin Quarterly Journal, 1868. This instrument was used for temporary igation of the abdominal aorta by Dr. W. Stokes, jun. See the same Journal Aug. 1869.

bears some resemblance to an instrument devised by Sir P. Crampton and d in the passage of South's *Chelius*, above referred to, except that the agent pression is silver wire. This is passed under the artery with an aneurism and is attached to a small frame made of bent wire, and provided with The wire is drawn through the ring tight enough to stop the circulati is then fixed by twisting it round the ring. When the desired effect h produced, it can be at once removed.*

Further experience, however, is necessary to show w these plans have any real superiority over the ligature u the ordinary way.

Brasdor's operation will be discussed along with the trea of aneurism in the neck, where it is chiefly, if not solely, empl

Treatment by Instrumental Compression.

The treatment of aneurism by compression is a practic almost as old a date as that by ligature;† but, like it, had fa out of use from certain imperfections in its details, until it taken up again, improved, and fitted for practical use by mod surgeons. The old treatment consisted in the applicatio continuous pressure either to the sac, to the artery above it to both; and the cause of its frequent failure, or rather of great rarity of its success in the hands of the ancient surg arose from their ignorance of the natural process, as we above attempted to describe it, which effects the cure of an isms. Not being aware that the deposition of laminated when once begun, would go on, under favourable circumsta to the entire obliteration of the sac in almost every case that, for the commencement of that coagulation, only a m rate check to the circulation would suffice, they always a at suppressing the circulation through the aneurism altoget and if possible bringing the sides of the sac into contact. It was therefore necessary, in their opinion, to use such an amount of pressure as could hardly be tolerated by any one of ordinary sensitiveness, and which, even if borne by the patient, was pretty sure to produce sloughing. It was from a similar ignorance of the curative powers of nature, and of the ease with which the nice balance between the force of the circulation and the reaction of the arterial walls may be restored, that the Hunterian operation, which had been recommended by the Greek and Arabian writers (whether practised or not, is another question), fell out of notice till that great surgeon re-invented it. Thus, in reading accounts of Guattani's cases, and of others in which the old surgeons attempted to cure aneurism by compression, we are at once struck by the fact, that the pressure was always either too severe or applied to the wrong part, and often both. For as they thought that the principal point was to exclude the blood from the sac, of course the chief means of doing so was to empty the sac by direct pressure. When this was impossible, the next thing was to compress the artery above so firmly that no blood could pass. The modern system of gradual and partial compression,* is entirely different in principle, and is a strict imitation of the process of spontaneous cure. We have seen that when an aneurism is cured spontaneously, it is in consequence of the circulation having received some partial check, by which laminated coagulum is deposited within the sac. Just so in the cure of aneurism by this method of compression. It is merely necessary to lessen the force of the circulation through the aneurism during sone considerable part of each day, and then usually in a few days, but sometimes not till the end of several weeks, it will be noticed that the œdema and venous congestion have quickly subsided, and that pulsation is diminishing in the tumour, that its contents are more solid (which may be known by its varying less in size according as the blood is shut off or let in from the artery when the finger is pressed

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* For other methods of making temporary compression on exposed a see the authorities quoted in the *Biennial Retrospect of the New Sy* 1867–8, p. 214.

† Heister is said to have been the earliest author who recommended p in the cure of aneurism, and Guattani the first surgeon who used it success; but this was direct pressure. See Bellingham, *On Aneurism*

‡ It may be interesting to recall Hunter's case: 'The aneurism was femoral artery, and the swelling appeared upon the anterior part of the a little above the middle, extending upwards nearly to Poupart's lig An attempt was made, by compressing the artery above the tumour by of an instrument somewhat resembling a steel truss, to give the blood i sac a chance of coagulating, and by that means put a stop to the prog the disease. But, from the pain which it occasioned, every attempt to m permanent compression on the artery proved ineffectual.' He then proce

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describe the progress of the case, the aneurism undergoing a spontaneous cure. (Hunter's *Works*, vol. iii. p. 602.) The pressure appears to have been applied too strongly, too constantly, and too much in one place. Yet Hunter was fully aware that the cure of aneurism was quite compatible with the persistence of circulation. Much more would surgeons who thought it necessary altogether to abolish the circulation fall into such errors.

* The other and still more modern method of total compression during a few hours under chloroform will be spoken of afterwards. It was of course impracticable before the introduction of anæsthetics.

on it), and that the anastomosing branches are increasing so as to be felt pulsating. When these signs are present, we may be pretty sure that the cure of the aneurism is not far distant.

It would be wrong to pass over in silence the history of this method, although the length to which this essay necessarily extends prevents me from saying more than a very few words on the part played by the Irish surgeons in introducing the treatment of aneurism by compression, and on the gratifying success which has attended that treatment.

It has been noticed above that Hunter treated a case of femoral aneurism by compression on the artery between the tumour and the heart (indirect pressure); and the same plan was adopted by Sir W. Blizard,* and is strongly advocated by Mr. Freer;† but the latter surgeon, and probably all who preceded those of the Irish school, unless Hunter be an exception, thought the pressure was to act by obliterating the artery. The pain was very great, in consequence of the assumed necessity of making very firm pressure always in the same spot; nevertheless, some few cures were obtained under the care of Pelletan (or Echard), Dubois, Dupuytren, Boyer, and Albers, and are quoted in Dr. Bellingham's work; but these cases of success were balanced by failures, which, according to Dr. Bellingham, were 'still more numerous;' and the treatment was so painful and so uncertain, that it seemed likely to fall into complete discredit, until Mr. Todd of Dublin recommended the use of the plan as an adjuvant to the Hunterian operation; his object being, by preliminary pressure on the trunk of the femoral, to cause the dilatation of the collateral branches, and so to lessen the risk of gangrene. For this purpose he made use of the instrument originally invented by Heister; but no striking results followed from this practice,‡ which was adopted by some surgeons in Dublin and decried by others, but regarded by all merely as an accessory to the ligature, until the accidental success of pressure applied in the case of a patient of Dr. Hutton's (Oct. 3, 1842), who refused to submit to the operation, shortly followed by similar success on a patient of Mr. Cusack's, whose health appeared too broken to enable him to survive the ligature, led to a better appreciation of the matter; and the striking success obtained in a patient of Dr. Bellingham's, the aneurism being cured in two days, drew the attention of surgeons in other countries to the matter, and successful cases followed, not only at Dublin, but also at University College Hospital under Mr. Liston's care, and in other parts of the kingdom. Still the great majority of the cases were treated in Ireland; and it is to the Irish surgeons, and especially to Dr. Bellingham, that the profession is indebted for the true theory of this method of cure. Their success in the application of the treatment has also been much greater than has been obtained in London. In Dr. Bellingham's small but very valuable work on Aneurism § (from which the above particulars are

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* Bellingham, op. cit. p. 28. † *On Aneurism*, pp. 94 et sqq.

‡ It is said, however, to have effected a cure in one unpublished case (Tufnell, *On the Treatment of Aneurism by Compression*, p. 27.)

§ *Observations on Aneurism and its Treatment by Compression.* Dublin, 1847. I exclude two cases in which galvanism was also used, and one of which proved fatal.

d) may be found short notes of twenty-five cases (most of them treated
nd), in which compression was used, and which included all that had
orted up to that date. In only one of these was it found necessary to
ligature of the artery, and then not on account of the failure of the
but in obedience to the wishes of the patient, who seems to have got
the treatment, though it appeared on the point of succeeding. (See
hell's work.)

xperience of English surgeons has been far less favourable. In the
Times, vol. ii. 1856, and vol. i. 1860, are to be found some valuable
of the cases which have been under treatment during late years in
ropolitan and provincial hospitals. Of the seventy cases included in
t report, which is believed by the reporter, Mr. Hutchinson, to be
ally accurate, as containing all the cases which had been under treat-
rty-six were popliteal aneurism, treated by pressure. The treatment
d in twenty-four of them. Of the remaining twenty-two, in whom
oral artery was tied, two only died of gangrene; while of ten cases in
the artery was tied without preliminary compression, three died of
e. The period of treatment in the successful cases varied from sixty
o eight months, nineteen days being the average time. The large
on of cases in which pressure failed will strike the reader. It is
that it was due to the novelty of the method; since in the second
which contains fifty-nine cases, treated either by ligature or com-
, the latter plan succeeded in twenty-five cases out of thirty-nine.
is, however, shows a far less striking success than was at first augured
method, and might have been expected from the experience of Irish
. It is possible that a greater proportion of cures may be obtained
ons become more acquainted with the method, and more alive to the
of attending to its minuter details. Meanwhile we may agree with
chinson's remark upon the above report, that all the success obtained
ression is clear and unbalanced gain; that in the cases which succeed,
nt is, with no appreciable danger to his life, withdrawn from the very
risk of the Hunterian operation, and in most of those that fail the
of that operation are diminished.

instruments required for the compression treatment are,
two compressors, and a weight encased in leather. I
lescribe the method as applied to the cure of popliteal
sm; if the brachial or subclavian were the subject of
ssion, the modifications would be easily made. The
ssors now in use are made on the principle of exerting
re upon a small space, without any circular constriction
limb. They consist of a plate or trough, which is applied
lower surface of the thigh at the point opposite to the
and a pad supported on this plate by a strong lever, or
nd movable in all directions. The lever stands well
rom the thigh, and the instrument is kept in position by
npression which it exercises. When applied, it is screwed
ipon the artery until the sensation communicated by the

aneurism to the hand is considerably lessened, say diminished about one-half; and is left so until the patient is sensible of inconvenience from it. It is by no means necessary to stop pulsation in the sac altogether, nay, it is not clear that this expedites the cure, unless it can be maintained long enough to cure the disease at once—but for this purpose prolonged anæsthesia is usually required. Patients of quiet temperament and rather blunt sensibility can often tolerate for a time the degree of pressure necessary to stop the circulation; but it will generally be found that even in them it produces injurious consequences, either because the pressure acts on the vein as well as the artery and so causes œdema of the foot, or because the nerves become involved, or perhaps because the sac (which of course shrinks when most of the blood has passed out of it) becomes too violently distended on the withdrawal of the pressure, and so the process of coagulation is interrupted. It is better, then, to commence with very mild pressure, to change the place of its application frequently, and to give the patient such intervals of complete repose as may refresh his spirits and procure him good sleep. The management of the compressor should be intrusted to some one who knows the course of the artery, and can judge of the direction in which pressure should be applied so as to command it. The course of the artery can be indicated by a line drawn down the limb with caustic, and any intelligent patient or nurse soon learns where to apply the pad; but the application of pressure in the right direction is more difficult.* When the patient has got tired of the sensation caused by the pad of the compressor, he can lay the weight upon the femoral artery in the groin, raising it for a few minutes occasionally; or very often the patient prefers stopping the pulse by the pressure of the finger, thus combining digital with instrumental compression.

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* Want of space forbids a complete account of the various kinds of compressors which have been invented for the treatment of popliteal and other forms of aneurism. Perhaps the best form, as obtaining the requisite degree of pressure with the least danger of producing a slough, and being, at the same time, least liable to slip, is Dr. Carte's apparatus, in which the screw carrying the pad is attached to the lever by means of india-rubber bands, and is movable in all directions on a ball-and-socket joint. It is very desirable, however, to have several instruments at hand, and to vary the point of pressure. The weight in the groin may be suspended by means of a string or wire, so as just to produce the necessary pressure without fatiguing the patient by holding it in his hand. Mr. Hart has contrived a plan by which the exact amount of pressure exercised is registered upon the compressor. This may be useful in preventing an excess of force from being unadvisedly employed. Much valuable information on these and other points connected with instrumental compression will be found in Tufnell's work on the subject. See also the essay on Surgical INSTRUMENTS.

The general treatment during compression is a point on which some variety of opinion exists. Some surgeons, even in the present day, when stimulation is so much in vogue, prefer to adopt the depleting plan, although not to the extent recommended and practised by Valsalva; but the majority consider that the advantages, if any, derivable from this course, do not equal the difficulties which the restlessness, discomfort, and distress it occasions to the patient, throw in the way of the treatment. I have seen the depleting plan tried once, but it seemed quite inefficient, and the case was the most protracted cure by compression which I ever heard of; while, on the other hand, a sufficient diet with a moderate allowance of stimulants, if the patient has been accustomed to them, appears not to retard the cure, and certainly renders him more disposed to submit to it. Some surgeons, acting on the idea thrown out by Dr. Stokes (see p. 436), prefer to feed the patient on a diet almost exclusively of meat, believing that the blood is thus made richer in fibrine, and more prone to coagulation. Opium is sometimes necessary to procure sleep; but if the patient be not of an irritable disposition, and the pressure has been commenced mildly, he can generally sleep quite well when the instruments are withdrawn; and cases occur occasionally where the patient can sleep undisturbed even while the compressor is applied.

There are two main theories as to the best method of making compression in the cure of aneurism. The one adopted by the Dublin surgeons, as above referred to, is, that a slow current through the sac, is, if not necessary, yet desirable, in order to the deposit of laminated fibrine; and that for this purpose the compression ought not to be applied to the artery tightly enough to stop the circulation. Consequently this plan involves a rather protracted treatment.*

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* The time required for the success of the treatment by gradual compression varies remarkably. In 26 successful cases, reported in the *Medical Times and Gazette*, the time varied from 60 hours to 8 months, the average being 19 days. In some of the protracted cases, the cause of delay has been the inefficient way in which the treatment has been carried out. Thus in the case of a ung woman who was under Mr. Prescott Hewett's care in St. George's spital, on account of popliteal aneurism, some years ago, the disease remained ationary, notwithstanding the constant application of pressure for months, ut was cured in a few days after her transference to the care of a different

The other theory is, that if the blood can be compl rested in the sac by compression stopping the circulat lutely for some hours, the soft coagulum which is at fir will gradually go on to complete induration and la and the cure will be thus effected much more spe much more surely. Experience is yet needed to show the slow or the rapid compression, *i.e.* the partial arre circulation for a considerable time, or its total suppress shorter period, is on the whole the best treatment, but facts exist to prove that aneurism may be cured in bo The total suppression of the current in the aneurism accomplished by making pressure below as well as a aneurism; and in ordinary cases the pressure can only by keeping the patient more or less fully under the infl chloroform. Numerous cases are now on record in wh patient has been kept for many hours under chlorofor cure has been effected.* In most cases it is true that compression, with intermissions, or partial instrument pression, have been previously employed; but this has always the case.

The cases to which the method by total compress most applicable are those of aneurism in the abdome digital pressure is impracticable, and instrumental com so painful that the patient must be narcotised in order to it. It may be employed, however, in any aneurism; popliteal aneurism might perhaps be tolerated without form. Here, however, the milder methods have been cessful that I should not myself be disposed to recom under ordinary circumstances.

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nurse. It was discovered that the previous attendant had been in th allowing her to remove the instrument and walk about the ward. cases, however, no such negligence can be detected, yet the cure progress for a considerable time, when a favourable turn suddenly the patient recovers rapidly. It seems impossible, with our present of the processes which go on in aneurismal sacs, to explain the these uncertainties; but the practical inference is, that as long as the not increasing, and the patient is not suffering from the treatm reasonable and advisable to persevere.

* See the *Biennial Retrospect of the New Syd. Soc.* for 1865- 1867-8. The longest period of pressure under chloroform seems to 12 hours in a patient under Dr. Mapother's care. By a misprint in the the above cited *Retrospects*, it is said that a patient was kept under for 97 hours—9½ was the time.

ries to the treatment by compression may be sought m of the limb and in direct pressure; but these nust not be insisted on if they appear to cause dis- thus endanger the success of the principal agent of i.

niselli has written on the use of direct compression in the treatment , in the *Annali Universali di Medicina*, 1867, vol. cxcix. p. 351.* ng several cases in which direct pressure was used as an auxiliary to with apparent benefit, he refers to two in which it was the only agent ras a case of popliteal aneurism under the care of Brunker, related in d *For. Med.-Chir. Rev.* Jan. 1840, in which pulsation ceased after nd the other a traumatic aneurism of the carotid under his own ch the pulsation disappeared after ninety-seven days. The agent ion in both cases, was a large piece of soft sponge firmly bandaged mour, and wetted once a day to give it the required elasticity.

compression succeeds, the case is precisely on the ing anatomically as when the disease undergoes the f spontaneous cure, so that the reader may be referred ias been said upon that head in a previous paragraph. es the artery becomes thickened and contracted where ure was applied, and it is possible that it might become d; but changes in the arterial walls are of rare e, and take place probably only when compression has rcised more vigorously and more continuously upon than is either usual or desirable.† Usually when a xamined after the successful use of compression, the ove the tumour shows no trace of its action (Fig. 161). our is generally quite firm, being filled with laminated i; but sometimes a channel is seen, through which n has gone on in it. All this will be seen to be with the spontaneous cure. Enlarged anastomosing are generally discovered, and this enlargement is ind rightly regarded as one of the earliest and best s of commencing cure.

ure of aneurism by compression does not, however, ivolve the obliteration of the sac, and does not, there- ays involve the establishment of any new circulation. nt is illustrated by a preparation in St. George's

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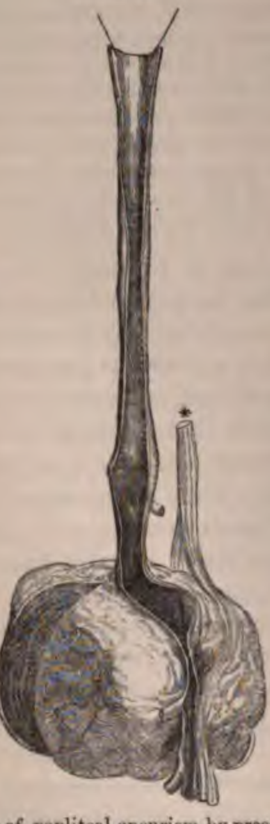
* *yd. Soc. Biennial Retrospect* for 1867–8, p. 290.

† *d.-Chir. Trans.* vol. xliv. p. 189, will be found a case in which a ieurism formed spontaneously at the part where pressure had been the femoral artery many months before the cure of aneurism.

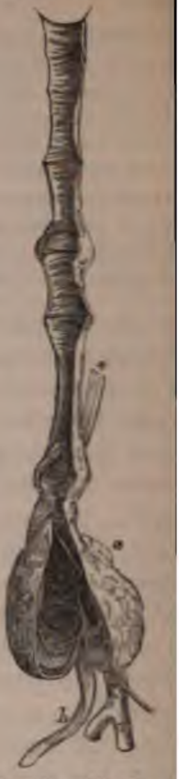
Hospital Museum (Fig. 162), in which a popliteal aneurism preserved, which had been treated by compression of the fem artery for more than two months. The sac lies between

Fig. 161.



Cure of popliteal aneurism by pressure. The artery remains pervious. The sac is seen to be filled with laminated coagulum. The asterisk points to the nerve spreading over the tumour. (From a preparation in the Museum of St. George's Hospital. Series vi. No. 121.)

Fig. 162.



The femoral and popliteal art a patient who died about months after the apparent cu aneurism by pressure. The had become stationary, and h him no further trouble. The of the artery out of the an tumour is seen just below t *a*. The artery itself is perfe vious throughout; *b* shows ternal popliteal nerve. Al whole of the sac is seen to be by laminated clot. (From a tion in the Museum of St. Hospital. Series vi. No. 12

artery and joint, and is entirely filled with laminated c except a channel at the back continuous with the arte forming a part of its tube. This method of cure is, h desired, since the clot may yield again to the force of lation,* and thus the disease may recur.

ilure of this method is due sometimes to the anatomical ion of the arteries, as, for instance, when a vas aberrans n the circulation though the aneurism from a point at which is compressed, and probably with more energy the main trunk is obstructed;† or it is due to slough-e skin under the pressure, to the patient's indocility or ional restlessness (by far the most frequent cause of or to some deficiency in the tendency towards coagula-ch renders the blood in the sac incapable of going the processes necessary for a cure without a more interruption to the circulation than gradual compres-nishes, and which must therefore be sought by total sion or by ligature.

reat advantage, however, of the treatment by compres-hat when it fails it seldom fails totally; for if it does eed in curing the aneurism, yet in almost all cases it ne disease under more favourable conditions for cure. ious reason is, that it produces enlargement of the l vessels, and thus obviates the tendency to gangrene so decided in the lower extremity after the Hunterian n upon the femoral artery. It seems highly probable, e, although at present the cases are too few to form any on, that the mortality from gangrene will be found much in cases treated first by compression, and afterwards by than in those where the artery has been tied at the

ression, however, although it is usually harmless, if not l, even in the cases where it is not entirely successful, ways so. Cases do no doubt occur in which the aneur-eases with much greater rapidity after the application ressure, and goes on rapidly to bursting. In one such skin gave way, and the patient died of hæmorrhage.§

Ir. Spence's case, quoted on p. 500.

case marked 24 in Dr. Bellingham's table (*Med.-Chir. Trans.* vol. 149) is an example of this peculiarity.

Times and Gaz. Nov. 29, 1856. It might occur to the reader that itage will be in some respect balanced by the increased facility with blood would find its way into the artery above the sac, and thus he circulation through it; but this does not seem to have been the y of the aneurisms so treated.

Times, 1860, vol. i. p. 118.

impossible.

DIGITAL COMPRESSION.

The treatment of aneurism by digital com
recent origin. It has sprung directly from
it must be said, also from the failures, of
mechanical compression.

The first recorded case in which digital compression
ployed for aneurism appears to be that of a patient treat
May 1844, and whose case was recorded by that surgeon
gical Transactions for 1845. In this case the thumb o
over the femoral artery in the intervals of compression b
aneurism, which filled the popliteal space, solidified in tw
this joint treatment by digital and instrumental compressi
Professor Jolliffe Tufnell,[*] treating a popliteal aneurism
tourniquet at the groin, found his progress impeded b
inguinal glands, and taught his patient to compress the fe
thumb until the swelling of the glands subsided. In
pressure by the finger was employed as a temporary aid
pression, rather than as a means capable of effecting the c

But in 1848 Dr. Knight[†] of Newhaven, United States,
ployed compression of the femoral by the fingers as th
The case was one of popliteal aneurism in a mulatto for
for whom every kind of tourniquet and apparatus had b
Before having recourse to ligature, Dr. Knight made tria
sion of the femoral; he obtained the help of a numb
relieved each other, two and two every half hour, maintai
sure to an extent which arrested pulsation in the tumour.

orne, and ultimately the external iliac was tied. His example was n the same year by Professor Willard Parker[*] and Dr. J. R. Wood,[†] ork, who achieved successes in the treatment of femoral and popliteal by the combination of digital and mechanical compression.

this interval the Dublin surgeons had not published any case in ital compression was employed. In 1852, Mr. Norgate[‡] recorded a pliteal aneurism, in which pressure by the thumb was temporarily in succession to mechanical compression. The tumour ruptured, and n was resorted to with success. And in 1854 Jameson[§] obtained a e mixed methods; he employed a Reid's compressor during six days lly, introducing with successful effect six hours of digital compression. r instance, Donohue, a patient of Mr. Colles in the Meath Hospital, serving that by compressing the femoral artery in the groin he eased of a diffused popliteal aneurism, quietly performed the compression ee days, so that when the surgeon came to fit on a tourniquet he t his patient had cured himself.[‖]

y, Professor Vanzetti, of Padua, obtained, at this date (November striking success in the treatment of popliteal aneurism by manual on; his patient was a healthy man, aged nineteen, the subject of a iteal aneurism of the size of an orange, and of five months' duration. l compression was made, by the hands of assistants, at the apex of riangle, and solidification of the tumour was effected in forty-eight thout pain and without diminution of the temperature of the limb. rofessor Vanzetti treated a second case of popliteal aneurism, in the a young officer, by similar means and with even more striking success. spontaneous popliteal aneurism of two months' date; the knee was t. The patient himself was taught to compress the femoral artery, ree weeks, and many times daily, each time from six to eight minutes; lidification followed. Methodical compression of the femoral artery ne point, as in the former case, was then applied during five hours, effect of solidifying the tumour, and affording a complete cure. Pro- nzetti, in recording these cases, mentions also that he applied the same the treatment of popliteal aneurism at the hospital of Karkof in 1846.[¶] After two days, finding it unsuccessful, he passed at once to re. It will be observed that, although unsuccessful and not published , this was the first attempt at curing an aneurism by manual com- olely; just as Dr. Knight's case, in 1848, previously mentioned, was nstance of a cure actually effected by the sole use of pressure by the ence Professor Vanzetti claims a priority as inventor of digital com- which has commonly been accorded to Dr. Knight.[**] The merit of nsisting upon the value of digital compression, and studying its appli- surgical treatment with a success which fixed the attention of

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a, p. 809.

[†] *Dublin Medical Press*, 1846, p. 150.

1852, vol. xxvi. p. 247.

[§] Ibid. 1854.

. May 1, 1854, p. 97.

ali Universali di Medicina, Jan. 1858.

orità del Metodo di curare gli Aneurismi colla sola mano, dovuta alla Chirurgia dell' Università di Padova, del Prof. Tito Vanzetti. Annali li, vol. clxiii.

European surgeons, is undoubtedly due to Vanzetti. These earl
were speedily followed by others equally remarkable. In July 185
patient came under the care of Professor Gioppi,* of Padua, the
aneurism of the ophthalmic artery; the case was one of great seve
portrait of the patient fully confirms the written descriptions: th
jected on to the cheek; it was motionless; the cornea was infiltrated an
the sight was gone. The pulsating aneurismal tumour could be
troducing the finger between the globe of the eye and the roof of
the bruit could be heard loudly. The carotid was compressed for
a minute or two, and, with frequent intervals, by the convalescen
ward and by the patient herself. Pressure continued for more than
produced fainting. Nevertheless, at the end of one day there was
improvement, and at the end of four days all pulsations had cease
months afterwards the eye rested and moved naturally in the orbit
was restored, the patient remaining only somewhat short-sighted, and
pupil slightly dilated. A second case, in which a formidable aneurism
ophthalmic artery, in a patient the subject of aortic and cardiac dis
cured by digital compression, was published, in 1858, by Drs. Vanze
Scaramuzza.† Intermittent compression of the carotid by the finger
also employed for five minutes at a time, and cure was effected by seve
and twenty minutes of compression spread over eighteen days. These
successes, real triumphs of conservative surgery, supported as they
abundant and irrefragable testimony, sufficed to place digital comp
amongst the most precious resources of surgery in the treatment of
aneurism.

The subsequent experience of surgeons who have employed this meth
Vanzetti affords numerous instances of cure, unrivalled for simplicity,
ness, ease, and rapidity in the records of the treatment of aneurism
other means. In nineteen cases successfully treated by digital pres
average number of hours of pressure was not more than forty-one and
spread, however, over a variable period of time, owing to intermissio
pressure. In a case which came under my own notice in 1868, the p
policeman, had had a popliteal aneurism cured in Guy's Hospital, un
Bryant's care ‡ by digital compression in about twenty-four hours.
turned to his duty, and in about a year afterwards a second aneurism fo
the opposite ham. Of the nature of this tumour there could be no doub
it was verified by his usual medical attendant, who had previously plac
under Mr. Bryant's care. The man went to bed, and imitated so suc
with his own thumb and fingers the treatment he had seen pursued
hospital, that he suppressed the pulsation in the sac completely and fi
four and a half hours. When I saw him there was no trace of the

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* *Annales d'Oculistique*, 1857.

† *Secondo caso di Aneurisma dell' Arteria oftalmica guarito colla comp
digitale della carotide, &c., del Dott. T. Vanzetti, &c. &c.* Padova, 1858.

‡ *Guy's Hospital Reports*, series iii. vol. xiv. p. 241. A case of tra
aneurism of the femoral artery, under M. Chassaignac's care, cured in sev
by digital compression, is related in *L'Union méd.* Dec. 2, 1862. Here, ho
the compression was continued as a precaution more or less during th
twenty-four hours.

d a little thickening in its old situation. Mr. Bryant informs me that he se met with another case in which the patient had cured himself in the nner.

gital pressure ought to be effected, when possible, by the d efforts of a staff of trained assistants (in hospital practice, lly medical students), who should make pressure in pairs for about ten minutes, relieving each other alternately. The who is not compressing should see that the other holds the y firmly, and commands the circulation through the tumour pletely during the whole period. The point of pressure ld be varied whenever that is possible, and great care ld be taken to impress upon the assistants, especially if they entirely ignorant of medicine, the proper direction of the ure by which the artery can be held with the least force, the great importance of not using more pressure than is lutely necessary. A reasonable time must be allowed for p, at least in most cases, undisturbed by pressure. Some ents can tolerate the constant application of the compres- for a day or two. It should not be forgotten that digital sure is by no means always painless, but on the contrary etimes more painful than instrumental compression. In h cases it should be given up, and the latter method stituted.

The cures, however, which are effected by digital pressure are en very rapid and attended with less pain than any of the er methods; and this kind of compression can occasionally applied to arteries, such as the carotid, where mechanical ssure is hardly practicable.

TREATMENT BY FLEXION.

The simple bandaging of the limb in acute flexion, the patient ing kept at rest, may occasionally succeed in curing aneurisms uated at the bend of the limb, as in the popliteal space or the ow, and possibly in the groin. This plan of cure had been eviously tried; but the merit of first demonstrating its success fairly due to Mr. Ernest Hart.* All that is requisite in this

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* For the details of this case, which I had the opportunity of seeing, in con- ltation with Mr. Hart, before the commencement of the treatment, see *Med.- ir. Trans.* vol. xlii. p. 205. In the same volume is the report of a similar ccessful case under the care of Mr. Shaw. The plan is understood to have en tried some time ago on a patient of Sir W. Fergusson at King's College ospital; but it seems likely that the trial was not very persistent. The

treatment is to bandage the limb from the toes nea
knee with a roller, and then to turn the roller round
flexed at an acute angle; the limb should then be bent
pelvis, and the knee rested against a pillow.

In Mr. Hart's case, the cure had made considerable advance aft
day of the treatment, and was complete on the fourth day; on the
patient was moving about. In Mr. Shaw's case, the cure was
protracted, and the cessation of pulsation was not reported till the th
day, but then the tumour was larger. In neither of these cases was a
system of diet enforced, nor did the patient complain of the least inc
in either. In a patient under my own care,* the aneurism, which
and recent, was cured, without any inconvenience or distress to the
two days. Numerous other successful cases have been put on reco
most interesting and important of these, in which genuflexion succee
the failure of the Hunterian operation, and of instrumental compressio
femoral artery, is reported by Mr. Spence in the *Edinburgh Medical Jo*
November 1859, p. 434. The patient had applied for advice originally
1857, on account of an aneurism, which had only been noticed a month, an
increased so rapidly while he was under observation, that the femoral
below the origin of the profunda without further delay. There wa
apprehension of gangrene after the operation, showing apparently that
culation was re-established only slowly. The ligature separated on the
ninth day, and then some undulatory pulsation was noticed in the
which, however, was much diminished in size. By bandaging th
cautious compression of the femoral artery, and direct pressure by a c
of lint over the tumour, this pulsation was reduced to a line correspon
the course of the artery, and not larger than the popliteal on the oth
The patient was then discharged, and returned to his avocation, that of
carter. In August 1858 he came to the hospital again, as the tum
suddenly increased within two or three days. It was then found to be
and pulsating as violently, as before the artery was tied. Compress
tried, and persisted in for five months, but the tumour increased ins
diminishing. It was then proposed to tie the femoral artery low dow
Hunter's canal, since the upper part of the superficial femoral
obliterated. Previous to this, however, it was thought right to give a
the flexion treatment; and this succeeded so well, that in a week the p
had very much diminished, and in a month the aneurism was quite c
contents being perfectly solid, and the anastomosing vessels enlarged
man again returned to his laborious avocation, and 'was presented
Medico-Chirurgical Society of Edinburgh four months afterwards; t
being quite complete.†

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details have been lost; and the fact was first mentioned after the pub
of Mr. Hart's case. Mr. Hart's case occurred in 1858. It seems, h
that the method was successfully used by Dr. Th. Maunoir of Geneva, i
See Richet, in *Dict. de Méd. et Chir. pratique*, vol. ii. p. 339.

* *Brit. Med. Journ.* 1868, vol. i. p. 585.

† A second case, under Mr. Hart's care, was communicated to the Royal M
and Chirurgical Society, in which the cure was effected in a few days w

ought to be noticed here that this man could not at first bear the complete
of the limb; accordingly a slipper, with a piece of bandage sewn to the
was fastened on the foot, and the bandage was then attached to a loop
ected with a broad band round his pelvis, and this loop was gradually
ued, so as to increase daily the flexion of the leg on the thigh. The con-
ent to bed appears to have lasted little more than a fortnight. This milder
of employing flexion may be often found successful when the patient
ot tolerate more rigid confinement.

ny cases are also reported in which flexion has been successfully used in
ination with pressure. In one under the care of Mr. Pemberton,* the
nt of pressure used was so slight that no great importance is attached by
to its action. Yet the aneurism, a large one, and pulsating strongly, was
d in less than twelve hours. A somewhat similar case is reported by Mr.
ritchard of Bristol, in the *British Medical Journal*, March 30, 1861.†

he failures which have hitherto been recorded appear not
ond what any other method of treatment is exposed to.

us in Mr. Moore's case, above referred to (p. 483), flexion was tried un-
ssfully; but then the tumour was large, and was growing rapidly towards
joint; and such cases are peculiarly intractable. In a case under Mr.
t's care,‡ this method was tried, and failed; but in that case other methods
atment also failed, the case not being one of aneurism in the proper sense
e term, but of ulcerated artery without a sac.

A case was in St. George's Hospital in 1867 of popliteal aneurism of two
ths' duration, in a man aged twenty-six, of dissipated habits. Flexion to
t a right angle, nearly but not quite stopped the pulsation. After eleven
s of flexion the pulsation had ceased entirely. It recurred, however, though
a very slight extent, from time to time, and the limb continued to increase
ize, until a portion of the swelling suppurated; and then bleeding occurred
n the tumour, necessitating amputation. On examining the limb the artery
s found completely divided into two parts. No mention is made of any
ious disease in the coats of the artery.

M. Liégois § gives an analysis of forty-nine cases of popliteal aneurism treated
flexion, founded on a thesis by M. Stopin. Twenty-six were cured, flexion
ng used alone in eleven cases, and in four after other methods had failed. In
remaining eleven flexion was used in combination with other measures. Out
he twenty-three cases which failed, seven are stated to have suffered rupture,
l one inflammation of the sac.

The cases best adapted for the trial of flexion are the simplest.
. those cases where the tumour is not of very large size, where
e parts covering it are not much inflamed, nor the joint in-

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en confinement to the recumbent position. (*Proceedings of the Royal Med. and*
hir. Soc. vol. iv. p. 37.)

[*] *Lancet*, Sept. 3, 1859, p. 232.

[†] See also a case by Mr. Colles, in the *Dublin Hospital Gazette*, June 15,
1860; and one by Dr. Leith Adams, *Med. Times and Gazette*, Jan. 26, 1861.

[‡] *Medical Times and Gazette*, 1859, vol. ii. p. 505.

[§] *L'Union méd.* August 14, 1869, p. 236.

volved, and where, as far as can be ascertained, the tumour is seated on the superficial face of the artery, we may anticipate benefit from flexion. If the flexion of the limb entirely, or almost entirely, suspends the pulsation and the bruit, this treatment may be trusted by itself; otherwise a compressor must be applied to the artery above, in aid of the flexion. But the compression need not, in such a case, be applied with nearly the same severity which would be demanded in an ordinary case.* A very slight amount of pressure will often serve; and if the only advantage of this simple and nearly painless proceeding were to spare the patient the annoyance of severe pressure, it would be no slight one. There are, however, many cases in which the aneurism will be entirely cured by it, without the smallest risk either to life or limb.

TREATMENT BY MANIPULATION.

A method of treatment has been founded on the consideration of the pathological changes which by the deposition of fibrine and occlusion of the cavity of an aneurismal sac lead to its cure, and the analysis of certain cases in which the accidental displacement of clot from within the sac, and its impaction in the artery on the distal side of the aneurism, has seemed to give rise to exceptional cures. Sir W. Fergusson has endeavoured artificially to imitate this process by means of a particular manipulation of an aneurism, whereby the fibrine within may be so displaced as, either in part or in whole, to block up the main artery on the distal side of the disease.

In a paper, which will be found in the *Medico-Chirurgical Transactions*, vol. xl. p. 1, that surgeon describes two cases which he submitted to this treatment. Both were cases of subclavian aneurism. The first patient was a healthy-looking man of middle age, having a large aneurism of two years' standing, involving chiefly the middle part of the artery. In the event of an operation by ligature having been determined on, the vessel must have been tied either on the tracheal side of the scaleni, according to the Hunterian method, or on the distal side, according to the method of Wardrop or Brasdor. Sir W. Fergusson thus describes his proceeding: 'The patient was seated in a chair: and I placed the flat end of the thumb on the aneurismal tumour so as to cover the prominence. I then pressed, until all the fluid blood had passed from the sac, and I could feel that the upper side of the aneurism was pressed against the lower. I now gave a rubbing motion to the thumb, and felt a friction of surfaces within the flattened mass. The movements were little more than momentary, but they were such as I had preconceived.' The immediate affect was to produce giddiness and mental confusion, so that the patient was

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* See Mr. Pemberton's case, above referred to.

able to stand. Pulsation ceased in the arteries below the tumour,
experienced in the hand and forearm. In the evening, however,
returned in these vessels. Next day the manipulation in the way
as repeated, with much the same immediate effects. Pulsation
rly, after some days, in the arm and hand. The tumour was thought
me manifestly less in size, and to pulsate less strongly. It never
ver, to pulsate, and eight months after, the patient died, owing to
he sac at the lower and back part. It was found to contain solid
d date, and recently coagulated blood. The axillary artery was
firm plug of fibrine. In the second case so treated by Sir W.
aralysis of the left side of the face, and of the left forearm and
the first manipulation, the pulse ceasing at the wrist. With this
ere was little material change. At the end of two months the
ned his occupation as a seaman, having regained the use of his left
e tumour being apparently unaltered. A year after, he was again
attempt made to keep up continued pressure on the tumour; but
unsatisfactory, that it was given up. Again, at the end of the
two years after the first employment of manipulation, he returned;
tumour had completely disappeared, there was not a trace of it to
; a slight pulse could be felt at the wrist. The arm seemed much
its fellow, and the paralysis of the left side had gone off.

of these cases afforded satisfactory evidence of the
safety of this mode of treatment. In the first case,
the tumour was considered to be somewhat solidified,
eased to pulsate; and after a few months caused the
he patient by bursting. In the second case no per-
ffect was produced on the tumour at the time, nor did
o be much changed at the end of a year; but after
of laborious occupation, the tumour was found to
peared. It must be considered doubtful how far this
due to spontaneous changes, or to accidental dis-
of the contents of the tumour in the course of the
requent exertions.

lden faintness of both these patients immediately after
pulation of the tumours, and the paralysis which
in the second case, indicated sources of danger con-
th this treatment, which Sir W. Fergusson did not
int out. It seemed possible that in the manipulation
e broken-down fibrine was squeezed towards the mouth
tebral or carotid arteries, and by obstructing the flow of
he brain produced hemiplegia in the manner suggested
irkes, who, in a paper read before the Medical and
al Society in May 1852, pointed out the probability of
tion being produced by fibrine from the valves of the
ng carried along mechanically in the blood. A case

highly illustrative of this danger has since been described by Prof. Esmarch.*

Captain C. H. consulted a friend of Prof. Esmarch's for tonsillitis, and at the same time drew his attention to a tumour on the left side of his neck, which had formed suddenly three years previously, without appreciable cause, and had now attained the size of a hen's egg. It was easily diagnosed as an aneurism of the common carotid. On repeating the examination a few days later, and exerting pressure upon the tumour for the purpose of reducing it, the patient fell suddenly back with symptoms of apoplexy; he was at once bled, and conveyed to the hospital, where he was placed under the care of Dr. Esmarch. There was right-sided cerebral paralysis; the pupils were dilated, but reacted to the light; the tumour pulsated simultaneously with the carotids, but presented no murmurs. Prof. Esmarch diagnosed the detachment of fibrine from the aneurismal sac and consequent obliteration of the left carotid. Death ensued three days afterwards. At the autopsy, performed by Prof. Weber, of which the most careful details are given, the sac of the large aneurism was found to be partly lined with more or less firmly attached, ragged, fibrinous coagula; much loose fibrine irregularly interwoven was also in the sac; a firm coagulum was drawn out of the internal carotid, and this coagulum was found to extend up to the carotid foramen. There was no coagulum in the external carotid. The cerebral carotid, the middle cerebral, and the ophthalmic artery were completely blocked up with coagula of a dark-brown colour, enclosing numerous red and greyish-white plugs, which evidently were derived from the aneurism. Their identity was proved by the microscope. There was considerable softening of the middle of the left hemisphere, including the corpus callosum.

A somewhat similar accident was described by Mr. Teale of Leeds, in some clinical remarks delivered in 1859.† He mentions that in the year 1847 he was one of a numerous consultation in a doubtful case of carotid aneurism. The subject of it was a middle-aged female, in good health in other respects. She was seated in a chair while the tumour was examined by several persons in succession, and subjected by them to repeated handling and compression. While this was going on, she suddenly became pale and slipped off the chair. On being raised, she was found to be hemiplegic; after lingering in this state a few weeks, she died. The tumour was found after death to be aneurismal.

These two cases serve to show very strongly the dangers which, as Sir W. Fergusson himself pointed out, are likely to follow the manipulation of aneurismal tumours of the neck. On the other hand, subclavian aneurisms are almost always ultimately fatal, and have never yet been successfully treated by the Hunterian ligature.

Soon after the publication of Sir W. Fergusson's paper, Mr. Robert Little‡ admitted into the Donegal Infirmary an Albino, aged fifty-three, having an aneurism of the right subclavian artery, of nine months' duration, of consider-

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* Virchow, *Archiv für Path. Anat. und Physiologie*, vol. xi. p. 410, 1857.

† *Med. Times and Gaz.* March 1859, p. 265.

‡ *Med. Times and Gaz.* May 23, 1857.

ating strongly, having a loud bruit, soft and compressible, some-
inflamed on the cutaneous surface. Anodynes, sedatives, local
nd venesection were employed without effect. On January 1,
ng gentle but steady pressure with the thumbs alternately over
l sac, Mr. Little succeeded in displacing some of the coagula, and
n towards the distal opening of the artery. No other local treat-
pted; but the patient was ordered a preparation of iron internally.
wo days no change was perceptible either in the tumour or the
he third day the pulse at the wrist was manifestly weaker, and
what colder than the opposite one. The symptoms gradually
to the tenth day after the manipulation of the sac, when no
d be felt in either the radial, brachial, or axillary arteries. From
tumour itself gradually became more solid, and finally all pulsa-
The tumour wasted to the size of a small walnut, and two super-
branches could be traced running transversely across it; one
bove the clavicle, the other somewhat higher up. For a time
artially paralysed and very cold, but it subsequently recovered
motion; and when the patient was seen a year afterwards, his
l respects complete.

to this highly satisfactory and interesting cure, Mr. Teale of
r. G. E. Blackman of Cincinnati, have each successfully treated
f the lower extremity by manipulation. Dr. Blackman * received
, in April 1857, a man, the subject of a large femoral aneurism,
e inches at the base. After forcibly manipulating the tumour
of dislodging the fibrinous contents, a Skey's tourniquet was
femoral artery immediately below Poupart's ligament. Much
lained of in the tumour, and the pulse rose to one hundred and
l and strong. The patient was bled to nine ounces, with the
ishing the pain, and bringing the pulse to fifty, soft and regular.
's the tourniquet was taken off, the leg was bandaged, and as the
high, venesection was again employed, and opium and tartarised
inistered internally. On the tenth day pulsation had altogether
cure remained good. The femoral artery is described as being
as the origin of the profunda, while in the popliteal space the
e artery was hardly perceptible.

however, very easy in this instance precisely to define
ve effects of the treatment by compression and that
tion, although the latter may be considered to have
nportant part in producing the cure.

reated by Mr. Teale compression of the femoral at the groin had
for some days, in the treatment of a popliteal aneurism, with
oducing some deposition of fibrine in the sac and enlargement of
els; but no material improvement having been effected, Mr.
d to produce displacement of the fibrine in the sac by moderate
The first attempt excited little change; he then repeated the
ith greater freedom, 'kneading the tumour in various directions.'
half after the last manipulation, the tumour had entirely ceased

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ancet, June 1857; *New York Journal of Medical Science*, 1857,

to pulsate, and had become a solid mass. Eleven days subsequen
patient left the hospital cured, the tumour having decreased rapidly in
he having been able to walk about the ward a few days.*

From the data furnished by these cases, which are th
ones bearing on this mode of treatment which I have
met with, a judgment may be formed of the uses and d
of the ingenious but somewhat hazardous practice of man
tion in the treatment of aneurisms.

TREATMENT BY GALVANO-PUNCTURE.

In the preceding modes of treatment of aneurism it is
posed to effect a cure either by retarding the course of the
or by introducing elements which favour the precipitation
plastic principle. Galvano-puncture aims at producing s
modification of the contents of the sac as shall favour
coagulation, without incurring the risk of introducing int
circulation foreign and perhaps injurious matters. This
occasionally accomplishes; but it is not without its own pe
accidents and dangers. Thus out of fifty cases of aneuris
treated, collected by Ciniselli,† twenty-three were cured, t
were not cured, and in seven instances death resulted. In
the first applications of electro-puncture made by Ben
Phillips,‡ Liston, and Gérard, in 1838, and the subsequent
of Mr. Keate,§ were so little successful as to discourage f
trials; and but for M. Pétrequin,‖ whose persevering ap
tion of this plan was, in 1845, followed by success, the pro
might not yet have found a place in practical surgery.
the publication of those cases, repeated applications
method have been made to all kinds of aneurism. But alt
these have served to show clearly the power of electri
effect the cure of aneurisms, they have shown also very
the danger and accidents to which it may give rise.
radical defect of this procedure that it acts by inducing
(or 'passive') coagulation of the blood in the sac. Hen
inherently uncertain, liable to cause relapse by the melt

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* *Med. Times and Gaz.* p. 265, March 1859.

† *Sulla Elettropuntura nella cura degli Aneurismi*, by Dr. L. Ciniselli
mona, 1856.

‡ *Experiments showing that Arteries may be obliterated without Ligatu*
the work of Phillips, London, 1832; and his Letter claiming priority of
tion, in the *Archives gén. de Méd.* 1847.

§ *Lancet*, 1837–8, vol. ii. p. 668.

‖ *Compte rendu de l'Acad. des Sciences*, 1845, vol. xxi.

oagulum, or inflammation by its too sudden deposition. n, it is very liable to set up inflammation in the walls contents of the sac. Then, too, the needles sometimes ce eschars at the points of their insertion, and thus give to consecutive hæmorrhage. In Ciniselli's Table, referred ove, the result of the forty-three cases which survived the ation is thus stated: of the twenty-three cured, six were subjects of grave accidents, seventeen recovered without ith slight accidents; of the twenty who were not cured, were the subjects of grave accidents, thirteen recovered out or with slight accidents. In fact, the cases are few in h a perfectly happy result has been obtained; but some of are worthy of particular attention.

s a subclavian aneurism, forming a tumour as large as a hen's egg beyond avicle, was cured by this method by Dr. Abeille.* The success of this lone, the size of the vessel affected, its proximity to the heart, the rapid e of the tumour, and the coincidence of constitutional disease, would to give importance to the method by which it was cured. Again, the sful application of galvano-puncture by Nélaton to cirsoid aneurism,† and icose aneurism at the elbow by Voillemier, afford instances of success in eatment of varieties of the disease not very amenable to other modes of ent. Two cases are recorded in which galvano-puncture has been em- l with some success in the treatment of aneurism of the ascending aorta; with the result of producing what is described as 'a very sensible and t improvement,'‡ while in the other the improvement was so great that tient appeared at any rate temporarily cured.

s latter case is so striking, and so well illustrates the method, that a short ct of it will be offered. It is reported by Signor Ciniselli, in the *Gaz. ôp.* Nov. 17, 1868. The aneurism was of the ascending aorta on the side, and was rapidly increasing; the third and fourth ribs, and the inter- space between them were much pushed outwards by the tumour; its ions were powerful, and very perceptible to the eye as well as to the . The patient could not lie on his back, was much troubled by loss of and quite unable to follow his occupation. At the same time the absence eration of the voice, and of obstruction to the jugular veins, with the d extent over which pulsation could be felt, rendered it probable that neurism was not of any large size. Three polished steel needles were l in the tumour, each penetrating the sac of the aneurism to about an inch th. The positive pole of the battery was first applied to each needle in ssion, the negative pole being placed in contact with the skin over the

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Archives gén. de Méd. Aug. 1849.

See infr. Cirsoid Aneurism. See also an interesting paper by Dr. Duncan, *Med. Journ.* April 1866.

Gaz. Medica di Milano, 1847, No. 2; Ibid. 1850, No. 33; *Gaz. Medica Ital. bard.* 1850, No. 44. Another case quoted here was unsuccessful.

tumour. This precaution is said by Ciniselli to prevent the form eschars. The electric-current was procured from a pile formed o square couples, each side measuring ten centimetres (about three inches), in a solution of sea-salt. The current was directed down two of the for ten minutes each, and the other for five minutes, the whole pro lasting forty minutes. The withdrawal of the needles was followed by bleeding, easily checked by saturnine compresses and ice. The same me reduced the redness and swelling, which was the only sign of local reacti general symptoms followed. The tumour rapidly diminished in promin in pulsation; the patient could lie on his back, and was able to sleep alm mediately after the operation. The aneurismal bruit, which had been v also gradually disappeared, and it seemed that the tumour had becom fied, though some pulsation could be still felt, which was thought to b the aorta transmitted through the solidified mass. He was kept quiet as possible; but ten weeks after the operation, feeling himself qu he resumed his occupation, that of a coachman.

From the study of numerous collected cases, it may that the *modus operandi* of galvano-puncture in cases cure has followed its application, has not always been id In some instances, the introduction of the needles into and the application of the current has apparently been f by the formation of a clot which only partially filled the ismal sac; and by virtue of the power which freshly de fibrine has of attracting to itself fresh layers of fibrine fr circulating blood, the clot has gradually increased in siz the tumour was solidified and cure effected. This is th favourable sequence, and may be regarded as the typical But this sequence is rare. In other cases, at the end sitting the sac is already filled with a more or less solid lum; sometimes this melts, sometimes it remains per and yields a cure. Most commonly, however, the intro of the needles has been followed by symptoms of inflam within the sac, and the cure has been due to the effect inflammation. Either coagulation has slowly followed u inflammatory action, or suppuration and obliteration of has been induced. The pain of the operation is in mo very considerable.

Dr. Althaus* has described a form of battery which portable and convenient for the removal of tumours,

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* *On the Electrolytic Treatment of Tumours and other Surgi* p. 12. Dr. Althaus differs from Ciniselli, believing that the negative ought to be brought into contact with the blood in the sac. He give of his own, but cites an iustance in which an aneurism was thus cured by mistake, for the operator had intended to apply the positive pole.

ent of other forms of disease by electricity. By immers-
ly the needle connected with the negative pole of this
atus in the sac, he believes 'a foreign body may be safely
ited in the sac, round which we may expect a slow and
al deposit of laminated fibrine to take place.'
these methods of cure must be considered as less satis-
y than those in which deposition of stratified fibrine is
y obtained. The risk of exciting inflammation in the sac
s contents is a very serious hazard, and the statistics of
method practically confirm the objections which we may
e simply from a knowledge of its mode of operation.
vano-puncture appears, then, at present to deserve to rank
as an exceptional expedient. Its claims will have to be
idered by the practical surgeon principally when he is called
to treat either aneurisms at the root of the neck, or in-
l aneurisms which cannot be reached by digital or me-
ical compression, and some forms of varicose and cirsoid
rism seated superficially. The dangers and imperfections
e process must restrict its application even in this limited
. But as a resource available in cases where neither com-
ion nor ligature can be advantageously applied, it has a
re of useful action.

TREATMENT BY COAGULATING INJECTIONS.

he treatment of aneurism by the injection of a coagulating
d into the centre of the tumour is so uncertain and so little
d that a short account of it must suffice. The first proposal
put forward by Monteggia,* who suggested alcohol, acetate
ad, and tannin as coagulating agents. Wardrop† suggested
ic acid, advising also compression so as to stop the circula-
above and below the tumour. But since the experiments
Pravaz on the effects of perchloride of iron, that substance
been chiefly if not solely used. Upwards of thirty cases so
ted have been collected; and there can be no doubt of the
ibility of thus coagulating a large portion at any rate of the
d in an aneurism. But this cannot be done without great
ger. The dangers proceed either from inflammation and
ess, set up in the neighbourhood of the sac, from inflamma-

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* *Instituzioni Chirurgiche*, pp. 68, 82, 124. Milan, 1813.

† Costello's *Cycl. of Prac. Surg.* i. 218.

tion of the sac itself, producing gangrene, or rupture of the aneurism, or from the consequences of embolism. In eighteen collected cases, the injection proved fatal four times; twice from gangrene of the limb, once from hæmorrhage following gangrene of the sac, and once from phlebitis. This is a formidable roll of accidents and a large proportion of deaths. It will seem yet larger, when we remember that it is a condition of primary necessity now recognised by all surgeons, that before the method of injection can be applied, it must be possible to arrest the current of the blood by pressure on the artery above and below the tumour. Thus it would be possible in nearly all these cases to apply either instrumental or digital compression or flexion; proceedings which can count a larger proportion of successes, and which are not open to the same objections.

The treatment by injection has been applied to nearly every form of external aneurism: to popliteal aneurism, by Niepce, Lenoir, Minor, and Isaacs; to carotid aneurism, by M. Dufour; to aneurisms of the elbow, by M. Jobert, Serres d'Alais, Vallette, and Dieulafoy; and even to aneurisms of the innominate, by M. Barrier; of the subclavian by Pétrequin; and of the aorta by Syme. The last three varieties are totally out of the domain of this method of treatment, because they are inaccessible to the compression of the artery on their cardiac and distal side; and without this precaution, the small clots formed by each drop of the perchloride on its entering the sac, are likely, as has been proved by experience, to be carried by the blood into the ramifications of the artery and produce gangrene. To repeat those experiments would therefore now be unjustifiable. Aneurisms of the popliteal artery, and of the extremities generally are susceptible of such satisfactory treatment by compression and flexion, that the more dangerous method of injection would here be out of place. An exception, however, must be made for those varicose aneurisms seen most commonly at the elbow after venesection, which have not always proved amenable even to digital compression, and in which deligation is somewhat complicated and difficult. Injection of perchloride of iron has four times been successfully applied to such a condition by Jobert, Serres, Vallette, and Dieulafoy; and proper precautions being used, this method may here be found advantageous. The same may also be said for cirsoid and anastomotic aneurism. (See Cirsoid Aneurism.)

When in any case it is determined to inject a coagulating sal, it is desirable to adopt certain precautions. In the first ice, as to the fluid selected. Various preparations of iron, ch as the lactate, the persulphate, the acetate of the sesqui-ide of iron, tannic acid, alcohol, and acetic acid, have been ommended and employed; but the coagulating power of the ution of the perchloride is so much greater than that of any these fluids, that it obtains the preference, notwithstanding irritating qualities. In order to reduce this irritating action its minimum, it is desirable to employ a neutral solution of the rchloride and one of feeble dilution. Very careful directions ve been given for the preparation of the solutions by M. Burin-buisson,* M. Soubeiran,† and others. In the earliest cases olution was employed of the strength of 45°—49° Beaumé, *i.e.* gr. 1·454 — 1·526; but experience has shown that solutions this strength are productive of excessive inflammation, and d almost inevitably to grave accidents. The experience of Valette has shown that a solution of twenty degrees possesses at coagulating power, and no higher degree of strength uld be employed. Care also should be taken not to inject excess of the perchloride; for this not only inflames the ues of the sac, but diminishes the solidity of the clot. M. ca advises the injection of twenty drops to every centilitre th of a pint) of the contents of the aneurismal sac. The nt experience of M. Dieulafoy (1859) seems to show that -tenth of this quantity may suffice; and that for an aneur-containing twelve centilitres, or three and a half ounces, teen to twenty drops only need to be injected. The best rument for the purpose is the small graduated syringe with w piston and glass body, made for the purpose by most rument-makers, and also used for subcutaneous injections. performing the injection, it is necessary first to establish urate compression of the artery above and below the tumour, s completely to arrest the blood in it. The pointed trocar plunged perpendicularly into the tumour, care being taken the one hand to enter the cavity, and on the other not to nsfix it, both of which accidents have happened to expe-nced operators. The success of the step is indicated by the e of *arterial* blood, an indication which should be looked for. cannula is now screwed on to the trocar, and so much

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Compte rendu de l'Acad. des Sciences, Jan. 16, 1854, vol. xxxviii. p. 89.

Bulletin de Thérapeutique, vol. xlv. p. 454, 1853; see also *Thèse de M. Jean* az, Paris. 1857.

as may be thought necessary of the injection is pushed out into the fluid contents of the sac by successive turns of the piston. Each turn is usually equivalent to half a drop, and the quantity injected may be further estimated by a reference to a scale, which should be marked on the glass body of the syringe. The point of the trocar may be directed upwards, downwards, and on either side, without withdrawing it, so as to form several centres of coagulation. When the tumour has acquired a certain consistence and the coagulation has sufficiently taken place, one turn backwards should be given to the piston, so as to draw up the liquid contained in the cannula and to prevent its irritating contact with the tissues; it is then carefully withdrawn. The compression of the artery on the cardiac side of the sac should be continued for an hour.

It is necessary to attend to these precautions very carefully, because experience has shown that owing to their neglect many of those serious accidents occurred which marred the success of the earlier cases. Notwithstanding their observance, it is to be expected that inflammation of the sac, with its attending disasters, will frequently follow the injection of the perchloride of iron; and since this method is mainly applicable to those superficial aneurisms which can be treated by other proceedings not open to that objection, and not followed by those dangers, the applications of the treatment by injection are likely to be limited.* The discovery of a fluid of great coagulating power, and devoid of irritating properties, is a desideratum in this method.

INTRODUCTION OF WIRE INTO THE SAC.

Mr. Moore has suggested† a method of inducing coagulation in the sac of an aneurism by means of the introduction of a large quantity of fine iron wire. The object of this proceeding is to detain the fibrine of the circulating blood, and thus to form a clot, much in the same way as in the common experiment of whipping the fibrine out of a mass of blood with twigs.

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* In Gurlt and Hirsch's *Jahresbericht*, vol. ii. p. 314, Berlin 1869, will be found a reference to a work by Signor Marsacci on this method of treating aneurisms, in which the author relates numerous experiments with all known kinds of coagulating fluids. The conclusion arrived at is that expressed in the text, viz. that the method is one not deserving of confidence, and which it is unjustifiable to employ in cases where compression can be used.

† *Med.-Chir. Trans.* xlvii. 129.

s purpose Mr. Moore inserted into an aneurism of large size connected arch of the aorta, and which was on the point of bursting both into the m and through the skin, twenty-six yards of fine iron-wire. The inserted through a fine cannula, the point of which was moved about performance of the operation (which lasted an hour), so as to coil re all round the sac. The cannula was provided with a probe made of ire rounded at the point, and large enough just to fill its tube. This ry, both to ascertain as nearly as possible the size and position of the of the sac, and also to push the fine wire out of the cannula into the the aneurism, for it is obvious that if the wire were left projecting out , ulceration and fatal hæmorrhage would probably ensue. Rapid coagu- s the consequence of the operation, the aneurism ceased for a time to nd the pulse-rate diminished from 116 to 78. But this favourable as transitory: severe inflammation of the sac and parts around soon set tion and tension returned in the tumour, and the man died exhausted by e fifth day after the operation. On post-mortem examination the proxi- use of death was found to be pericarditis, evidently induced in some y the inflammation set up in the large sac, which was in close proximity ricardium. There were also scattered abscesses in the kidneys, but these were produced by the impaction of clots carried down from the , seemed, to say the least, doubtful, since traces of a similar action at an riod were detected in those organs. The sac was bilocular, a larger ng in front of the bones of the thorax, which had been eroded. This l with a firm and adherent coagulum enclosing the coils of wire. The ouch had not been entered by the wire; but a clot projected into this gh it into the artery, part of which had probably formed after death, rtion was decolorised and laminated. The opening from the inner he aorta was hardly as large as a sixpence.*

ve thought it right to refer to this case somewhat at as illustrating the latest of many propositions for the ent of aneurism incurable by the ordinary methods; but t feel myself able to pronounce a decided opinion as to r the proceeding is less or more dangerous, and less or kely to succeed than galvano-puncture, which is the only vailable method in such cases. It must be remembered, one hand, that it has only been tried once,† that a very quantity, probably too large a quantity, of wire was and that a very considerable deposit of adherent fibrine oduced, accompanied by great temporary amelioration symptoms. These considerations might lead one to at in a future trial with additional precautions better

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coagulum which was formed around the wire is to be seen in the Museum liddlesex Hospital. It is almost as large as a cricket-ball, firm, and decolorised. A smaller piece of clot is also preserved which projected lesser sac and the opening of the artery.

ery brief report of a case thus treated at Liverpool without success lished, I am informed, soon after Mr. Moore's.

been withdrawn when the coagulation has
far advanced. M. Richet mentions* five case
has been adopted, but in no case with any s
with very grave accidents. In another case
a very small temporal aneurism was treate
needles and tying a ligature beneath them
with success. This, however, is quite a di
Velpeau and Mr. B. Phillips, are also referr
as having performed experiments to prove t
be treated in this manner; but I do not fi
used acupuncture on the living body, exce
with galvanism. In my opinion, as far as
from the few cases recorded, galvano-punctur
measure, and more likely to prove successful
without galvanism.

TRAUMATIC ANEURISM.

By 'traumatic aneurism' is meant a
blood, communicating with the cavity of an
a wound of the vessel. Three descriptions
to the formation of a traumatic aneurism
trating from the surface; 2, a tearing or st
the vessel without wound; 3, fracture of a

The first is the most common, or at least t
recognised† cause of traumatic aneurism.

limb, such as cold, numbness, tingling, and a feeling
ght; and later on he discovers that a pulsating tumour
beneath the scar of the wound.

such a simple case it is easy to see what has happened:
rtery has been penetrated by a wound which was too large
closed by the mere efforts of nature,* but which did not
he tube across, and did not stop the circulation. The
has not had a very direct exit by the skin-wound, pro-
in consequence of the altered position which fasciæ and
membranous structures assume in deep wounds, under
ng conditions of pressure, tension, &c., and therefore the
ing has not interfered with the healing of the opening in
kin. Meanwhile, below the fascia blood has continued
ude into the cellular tissue among the muscles, forming a
diffused ecchymosis. This ecchymosis may continue for
time to increase; such, however, is not necessarily the
since as much of the blood may be withdrawn from the
ar tissue by the action of the absorbent vessels (the veins,
possibly the lymphatics), and by reflux into the artery
g its diastole, as is poured out during the systole. Sooner
ter, however, the presence of the blood acts as a source of
tion, and sets up inflammation in its neighbourhood.
causes condensation, and then contraction of the areolar
e, and so a sac is formed. By this time, probably a great
of the blood has coagulated, and so the aneurism (as it
is) contains a mixture of clotted and fluid blood, as most
risms do. In other cases the wounded part of the artery
lieved to have yielded to the force of the circulation, and
sac is therefore formed by the tissue of the artery itself.
point is one of no practical importance. When traumatic
rism is fully formed, the case differs in no respect from
of spontaneous aneurism, except, perhaps, in its greater
eness to cure, since the heart and arteries are probably
thy; while in spontaneous aneurism they are often
sed.

e symptoms of traumatic aneurism following an open
d are generally distinct enough. The scar of the wound
be discovered even if the history is obscure, and the pulsa-
and bruit are generally distinct. But it must not be
tten, that before the sac has been formed, pulsation is

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* See vol. i. pp. 744–748.

the cure of an aneurism, such as pressure o or its ligature at a convenient spot above tl of requiring the frequently severe and necessary for exposing and securing the wo vessel.

Traumatic aneurisms differ in rapidity formation according to the nature of the tis wound communicates; whether the wound b filled with loose cellular tissue, or a space w be bound down and disposed in extensive me by contiguous fasciæ or tense muscles. Tl orbit, traumatic aneurisms of large size soo to the main artery, or even to a comparati The well-known case of Lieutenant Seton this fact. A wound of a branch of the patient being stout and the cellular interva occasioned an extravasation of blood, which to lead to the belief that the parent vessel In the limbs, on the contrary, the formatic consequence of wounds of large vessels is mo formed, they will often undergo a process of by rest and simple measures. The reason fo that before aneurism has formed, the blood tal pressure is the most efficient and safe, if circumstances ow us to secure the services of a relay of attendants, who ll make gentle and steady pressure with their hands over the . Or in very small aneurisms lying against a bone, the ient may be directed to keep his finger on the pulsating rt whenever he can. I have seen a small temporal aneurism, result of the blow of a stone, thus treated with sufficient cess to avoid the necessity of any other treatment. In ger and deeper tumours some form of bandage, with the rvention of an air-pad, may be necessary. Forced flexion he limb is of course often advisable. With direct pressure y be combined the compression of the trunk leading to the lling,* and the limb should be raised.

If these means fail, the artery must be tied. Some authors fer in these cases the method of Anel to that of Hunter, uing justly, that as the artery will be found healthy close to tumour, one of the advantages which Hunter's method has r Anel's operation is lost.† This is quite true; but the general vantage of Anel's method over Hunter's, *cœteris paribus*, is y slight, since the mere fact of there being a portion of artery rvious between the ligature and the tumour hardly ever affects e progress of the case. If, therefore, the tumour be deeply ated, and it would be difficult to expose the vessel, as it leads to it, no hesitation need be entertained in trusting to the unterian method; while if (as is usually the case at the bend the elbow) the tumour and the artery on which it is seated be perficial, the whole operation of opening the sac and tying oth ends of the vessel offers no special difficulties, and is certain to succeed. It is therefore often adopted; and we shall ee, when treating of axillary aneurism, that it has been recommended by a high authority for general use in that form of the disease. Still, the great majority of traumatic aneurisms have yielded to the proper application of pressure, and few of those which have not done so are known to have resisted the Hunterian operation. It is only in cases in which the tumour is superficially seated, and the operation therefore comparatively

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* See a case of traumatic aneurism of the radial artery, cured by a combination of forced flexion of the elbow and compression of the brachial, and afterwards by extension of the arm; *Brit. Med. Journ.* 1860, p. 859.

† It will be remembered that Anel operated for a traumatic aneurism at the bend of the elbow.

The difference seems to consist in the comp
sion of the coats of the vessel; the former
external to the artery, the latter to the form
and the obliteration of its tube. It is pos
some aneurisms (and amongst others ma
spontaneous) may arise from the laceratio
injury of the middle coat of an artery, and t
blood through the space thus left into the
it distends.* The point is one of anatom
practical interest.

Notwithstanding the remarkable immu
enjoy even in the most formidable injuries,
that, as they lie so close to the bones in m
should occasionally be wounded by splinter
sudden stretching in fractures. This accid
and it usually happens in such severe injur
is necessary: some cases, however, are left,
of an artery occurs as one of the compl
fracture, or of a compound fracture in whi
are not very grave. In the latter case, no
exist in deciding on the necessary treatmen
be saved, the wound must be enlarged, an
vessel treated irrespective of the fracture.
blood-vessel is wounded in a simple fract

may be obscured by the ecchymosis and other swelling. in, bruit may be heard at the seat of the injury; and this, ough it does not quite settle the point,* yet is perhaps the accessible and trustworthy of all the symptoms.

ow, in such a case as this three courses are open: viz. to down on the seat of fracture and search for the bleeding el; to amputate the limb; or to leave the case to the ers of nature, aided of course by rest and suitable position.

n John Bell's *Surgery* this species of traumatic aneurism is fully discussed; and he seems to have been of the opinion it was always necessary, in cases not severe enough to de- d amputation, to cut down and tie both ends of the vessel.† t this severe operation is, at any rate, not always necessary, clear from the fact that four cases have occurred at the ddlesex Hospital, under the care of Mr. Moore and Mr. tchell Henry, in which such traumatic aneurisms have formed d have got well spontaneously. Short notes of one of these es, which was under Mr. Moore's care, may be appended, as strating the subject better than a lengthened disquisition.

A woman, aged forty-two, presented herself in the middle of the day, ing on the previous night fallen downstairs and injured her right arm.

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* A case occurred at King's College Hospital, in which, after injury, with rotrusion of one eye, a bruit was distinctly heard over that side of the head. o hesitation was experienced in coming to the conclusion that the case was of aneurism in the orbit, and the carotid was tied. The patient died; and after death no trace of aneurism could be perceived. The cause of the sound remained obscure. The case will be hereafter referred to under the head of Orbital Aneurism.

† 'When an artery is thus lacerated, along with fracture of the bones, you have but this alternative, to cut the limb off at once, if it be very desperately wounded, or to try to save it, by making incisions and tying the artery. The fracture is already complicated with aneurism, and you are under the dangerous necessity of converting this complicated aneurism into a compound fracture. You apply your tourniquet, make a long and deep incision, turn out the coagula of blood with your fingers, cleanse the sac with sponges, search for the artery, and tie it up above and below where it is torn. You wash out the blood from the sac with syringes and sponges, for while it lies betwixt the bones they cannot unite; what blood you are forced to leave melts down into bad matter and flows off; the deeper parts of the wound gradually digest, granulate, and fill up with soft flesh; and when the continuity of the parts is thus restored, the new bone or callus begins to form. Such is the activity of a wounded artery in forming its aneurism and destroying the surrounding parts, and so complicated is the disorder when a wounded artery is added to a fractured bone, that unless these operations are performed early, the limb is inevitably lost.'—John Bell's *Surgery*, Charles Bell's edit. 1826, vol. iv. p. 404.

halfway up the inner side of the arm, and more
whole palmar surface of the fore-arm. A distinct b
stethoscope in front of the elbow. The two arteri
forward and so forcibly, and appeared so much larger
side, as to give the idea that they had been raised b
that the pulsation was communicated to the distende
The skin of the hand was dusky from congestion ;
driven away by pressure, it returned very slowly, s
condition of the circulation. The limb was everyw
there was no sign of impending gangrene. A consult
various opinions were expressed as to the appropria
agreed that there could be no doubt that some la
brachial, was wounded. It was ultimately decided to
evening the swelling was found not to have incre
certainly less tense. A rounded swelling was found
neighbourhood of the brachial artery, which appear
clot of blood. On the following day (the third from
had ceased in all other parts, and was perceptible onl
over a space about as large as a half-crown, and n
aneurismal pulsation finally disappeared, and the swel
subsided. When the subsidence was sufficient, fract
the humerus was detected. The case did well.

Of the other three cases, one, under Mr. Henry's c
posterior tibial artery, in a boy who suffered from si
The diagnosis rested upon the absence of pulse in the
of bruit, together with peculiar restlessness of the li
slowly (in about two months), and the above sympt
but the pulse did not return in the affected artery.
Moore's patient), one of simple fracture of the femur i
there was extensive swelling, together with arterial b
the femoral—which could be felt below the seat of inj

the mere occurrence of spontaneous cure, to the decided ency to recovery manifested by wounds of healthy arteries a uncomplicated by external injury.* But if an aneurismal should form, its formation, far from being an unfavourable re in the progress of the case, is part of the process of cure. ems abundantly clear, therefore, that surgical interference ese cases can only be justified by the presence of alarming toms; and that, by the aid of simple position, and perhaps ppropriate cases light and even compression, a great number teries wounded in fracture will heal.

e clot sometimes softens, and suppuration occurs; and this a may lead to the spontaneous cure of the injury. An inting instance of this spontaneous ejection of the clot be found in Ormerod's *Clinical Collections*, p. 143, after re of the femoral artery in a child, the patient recovering, only the loss of two toes by gangrene; but the limb was ss.

iere are, however, no doubt, cases in which things do not eed so favourably; and this unfavourable course tends in one ro directions—either that no aneurism forms, but the exsation of blood increases, and thus the circulation is so far rbed that gangrene is either commencing or appears imnt; or that an aneurism has formed, and its increase calls ome operation to check it. If no aneurismal sac has been ed, and the extravasation of blood is increasing, gangrene soon commence. The only way to prevent it would be to cut ı, as recommended by John Bell, upon the wounded vessel; the opportunity will rarely occur. When gangrene has lutely set in, it appears theoretically possible that a similar tice might be occasionally advisable; but in all the cases of h I have knowledge, amputation or death has been the native. Still, the relief to the circulation afforded by the val of the extravasated blood might, in some rare cases of

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er by Mr. Syme (see infr. Axillary Aneurism). The patient, a woman, supposed to have met with a dislocation of the shoulder, which was ht to have been reduced. A very large aneurism formed in the axilla. amour was laid open. Great hæmorrhage followed; but this was soon ed, and both ends of the vessel were tied. The woman died. It was found the artery had been wounded by the sharp ends of a fracture of the neck e humerus.

I would remind the reader of the many instances in which arteries have wounded in subcutaneous section of tendons, and the rarity of consequent hief.

injury to the upper extremity, deter
down upon the seat of injury, as a la
at any rate of a hand in which gang
menced. This is a matter which wo
individual judgment, based upon the
hand. In the second case, that in
formed and is advancing, the treatmen
that of aneurism in other circumstan

The two cases related by Dupuytren* are
own practice; one under the care of Delpec
back of the leg (the popliteal, or one of its
been torn in a comminuted fracture of the
swelling formed in the ham; and the surge
thigh, fearing to lay open so large a cavity
upon the seat of fracture, and being unaware o
in such cases, cut down on the femoral arte
recovered, without a bad symptom.

These cases are interesting, and
bear a striking resemblance to M
above (p. 519); and it seems very p
been similarly treated, they might
taneous cure, in the same manner as
there referred to did. In neither o
Leçons orales was there an aneurism
sufficient time had not elapsed for the
the clearness of the pulsation rend
ecchymosis was tending to become lim
soon form; and this appears to furnis
waiting and watching the result. W
it is a sign that the cellular tissue is c
This is very likely to lead to deposit
the sac. At any rate, it is highly imp
will begin to increase rapidly, since
rest and the limb in an appropriate
ever, increase, compression of the
method most probably indicated, per
sion on the sac, if the fracture is su
the fracture be firmly united, it may
to forcible flexion. In cases, howeve
wounded, as well as in those where it
very slowly. This may be noticed in

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* 'Sur les Anévrismes qui compliquent le
tome ii. pp. 521, &c. Paris, 1839.

l, quoted above, and has been observed by Dupuytren rs; so that the treatment of traumatic aneurism from , if it increase while the patient is lying in bed, will be ression or ligature of the main trunk; and in cases so abling Mr. Spence's, quoted on p. 500, that the aneurism arently consolidated during the repose necessitated by ure, but recurs on the patient resuming his active avo- the treatment there pursued (that of forcible flexion) probably be as successful as it was in that case, should tion of the tumour render it applicable.

isms the result of fracture are not confined only to the of the limbs, but may form in any part where an artery ciently near to a bone to be involved in the injury. Thus k and Mr. Curling have each put upon record a case in traumatic aneurism formed upon the ophthalmic artery sequence of fracture of the base of the skull.* In both e carotid artery was tied, and with complete success. w on Orbital Aneurism.)

re of arteries.—The complete subcutaneous rupture of y from a blow, strain, or wrench, and the consequent ation of blood into the cellular membrane, is the form of hich is usually, though incorrectly, called a 'diffused ic aneurism.' It should be called what it is, viz., 'rupture' ration' of the vessel. The injury is more commonly he popliteal than in any other vessel, and next in the from obvious causes. The symptoms are, failure of the low the seat of injury, great swelling of the limb from of blood beneath the fascia, and remarkable loss of ture. Pulsation cannot be detected unless the collection is becoming encysted (*i.e.* the case is passing on to the n of aneurism)—at least this has been the case in all the s of this injury which I have seen. Bruit can usually be ut this symptom is variable. I regard the loss of ture as a most valuable sign of the injury. In some rupture may be at first only partial, and then some may be detected in the vessels below the injured part.†

Chir. Trans. vols. xxii. xxxvii. See also the first of Mr. Nunneley's l. xlii.

case under Mr. Brodhurst's care reported in the *Path. Trans.* p. 74. Here the rupture seems to have been rendered almost y the exertion of taking a long walk. See also a case under Mr. wkins' care, in *Poland*, op. cit. p. 24.

Mr. Poland* believes that in such cases pulsation is m to be found in the collection of extravasated blood t the artery is completely ruptured.

The treatment of this injury must depend on the volved. When the symptoms of rupture of the poplit have been well marked, I have never seen a case ultimately amputation or death has not followed, I find any recorded case which is to my mind sati Hence I think the best course is to amputate at on the loss of pulsation and the fall of temperature indicat that the artery is completely torn across. In smaller and in those of the upper extremity, even as large a the axillary, the proper course is to cut down upon an the vessel. When partial rupture is suspected, a trial given to compression of the trunk leading to the injured

The accompanying vein is often also ruptured, es when the artery is torn completely across. I am not awa any symptoms exist by which this complication can be dis recognised; but its known frequency constitutes an add motive for amputation in such cases. Sometimes the po nerve has also been torn.

ARTERIO-VENOUS ANEURISM.

Under this title are included two forms of aneurismal dil of an artery, communicating with a vein, known respe as varicose aneurism and aneurismal varix.†

Varicose aneurism consists of a circumscribed cons aneurism, which communicates with the artery on one si the vein on the other. The vein is always tortuous and d sometimes to an enormous extent. In aneurismal vari is no aneurismal sac. Adhesion has occurred betwe artery and the vein at the point at which they communicat the blood is projected directly from the artery into t at each pulsation. Here also the veins connected w diseased part are greatly dilated, and the embarrassment circulation thus produced is the chief symptom of the af

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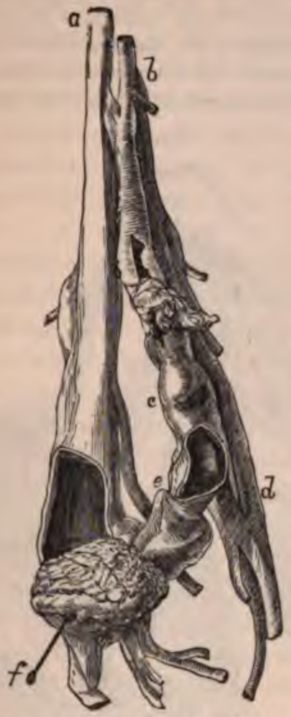
* 'On Rupture of the Popliteal Artery,' &c., from *Guy's Hosp ports*, p. 32.

† William Hunter was the first to describe arterio-venous accurately; and he also pointed out the difference between an aneuris and a varicose aneurism, though he did not use those terms. See *Chelius*, vol. ii. p. 272.

The usual condition of a varicose aneurism is shown in the accompanying ure, drawn from a preparation in the Museum of University College. Another teresting peculiarity is also to be noticed in this preparation—viz. that there a high division of the brachial artery, and that therefore a ligature placed on what was supposed to be the brachial artery might have failed to cure the

FIG. 163.



rawing, from a preparation by Mr. Liston,* of varicose aneurism at the bend of the elbow, in the Museum of University College, London. There is a high division of the brachial. The artery on which the aneurism is seated is the radial, which communicates very freely with the ulnar by a large transverse branch just below the sac. A probe has been passed from an opening in the skin (probably the puncture of the phlebotomy) through the vein and aneurism into the artery.—*a.* The basilic vein. *b.* The brachial artery dividing above the usual level. *c.* The radial, on which the aneurism is seated, and which has been tied a little above this point. *d.* The ulnar anastomosing freely with the radial just below the aneurism. *e.* The arterio-venous aneurism, constricted at this part by the bicipital fascia. *f.* The probe passed through the puncture, made in phlebotomy, and from which hæmorrhage occurred during life. It is not known whether the patient died of this hæmorrhage, or whether the arm was amputated. (I am indebted to Mr. Marshall for the particulars stated above.)

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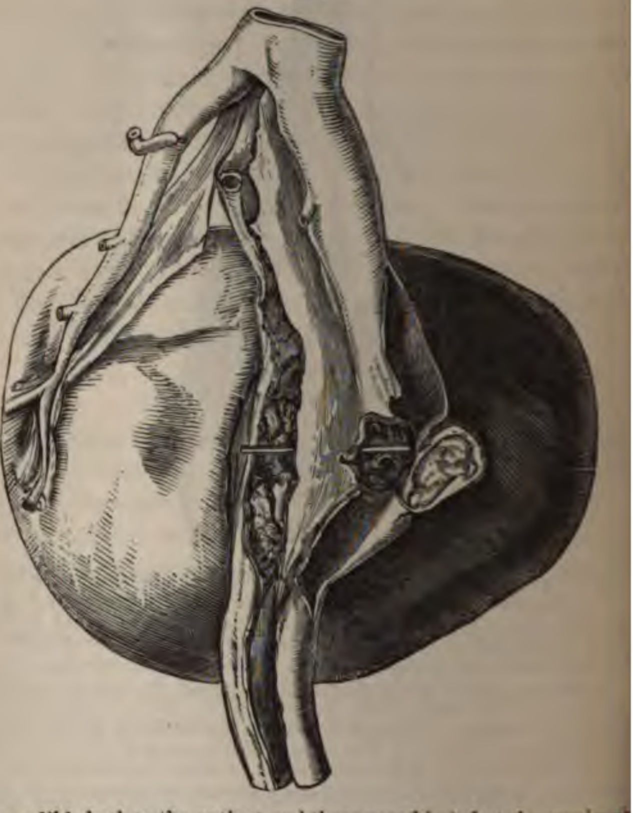
* I have not been able to find any reference to this case in Mr. Liston's ublished works, although there is an allusion to the possibility of failing to ure aneurism by ligature of the brachial, in consequence of high division, in ol. ii. p. 307 of his *Elements of Surgery*, ed. 1832.

disease, being applied to the wrong vessel. Even if the right vessel alon been tied, the other branch of the brachial anastomoses so freely just belo sac, that it might have prevented the formation of a clot. The hour-glass of the sac is attributed, in the Museum Catalogue, to constriction by the of the arm.

Another and very unusual form of arterio-venous aneurism is shown i accompanying figure, which is drawn from a preparation presented b Beaumont of Toronto to the Royal College of Surgeons. The patient under chloroform, administered for the operation of tying the external artery.* In this singular case, the communication between the artery and vein appears to have persisted for ten and a half years (as evidenced by a cont

FIG. 164.



ous bruit, audible both to the patient and those near him), but the aneurism formed at the end of this long period, whilst the patient was on horseback. Th vein is here obliterated both above and below the aneurism; but there is large opening between the vein and the artery. The usual signs of arterio-ven aneurism were absent, there being no venous murmur in the tumour, in conse quence of the obliteration of the vein. In such a case, the Hunterian opera which Mr. Beaumont contemplated, would no doubt have cured the pa, had the patient avoided the risk of gangrene, to which he was peculiarly ed from the occlusion of the vein, and the pressure exerted by the tumour e profunda artery.*

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* *Medical Times and Gazette*, July 27, 1867.

oth varicose aneurism and aneurismal varix may originate taneously, though they are more commonly the result of an ry in which the artery and vein have both been wounded. ar the most frequent cause is the unskilful performance of section at the bend of the elbow. Hence the affection is ly seen now, when the operation is not often performed, and by surgeons. Any other punctured wound, however, may rise to the disease, as the wound of a small shot, or the ment of a comminuted fracture; and so, it is said, may a ple contusion.†

n spontaneous arterio-venous aneurism, the communication a the vein apparently follows upon the development of a ple arterial aneurism in the contiguity of a vein. When an urism is formed on a large artery, in such a part of the artery o compress a neighbouring vein, it is common to find that n obliterated; and in the museum of every hospital there may seen preparations showing the obliteration thus effected of largest veins, the venæ cavæ being frequently so occluded. t occasionally, in lieu of effecting the closure of the venous nnel, the pressure of the aneurismal pouch of the artery es rise to absorptive ulceration of the coats of the vein, and sac opens either by rupture or by ulceration into that vein. is happens especially within the thoracic and abdominal rities, when aortic aneurisms press upon the great venous nks of the chest and abdomen.‡

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[*] An interesting case of a wound of the profunda femoris and its accompany- vein, treated by ligature of the external iliac, with a fatal result, will be nd in the *Gaz. hebd.* 1864, p. 166.

[†] It is perhaps worth notice that the communication may occur between o vessels which are not naturally in contact, but which have been brought gether by the force which inflicted the wound. Thus in the Museum of St. rtholomew's Hospital, there is an interesting preparation (ser. xiii. No. 121), in hich a small sac is formed communicating with the internal jugular vein and e external carotid artery. The cause was a punctured wound from the point f a pickaxe, and a small fragment of the iron has lodged and is impacted rtly without and partly within the cavity of the vein.

[‡] The earliest and most complete monograph on these forms of aneurism is due to Thurnam, *Med.-Chir. Trans.* vol. xxiii. See also Rokitansky, *Ueber inige der wichtigsten Krankheiten der Arterien*, Wien, 1852, p. 46 et seq.; Porter, on 'Arterial Disease,' in Todd's *Cyclopædia of Anatomy*; Nélaton's *Clinical Lectures*, by Atlee; Mayn, *Dublin Med. Journal*, 1854.

Less frequently, arterio-venous aneurisms arise in the same way on the limbs, and on other parts of the trunk. Sometimes these occur long after the infliction of a wound which had affected the artery, but which had been perhaps almost forgotten.

Thus Rokitansky observed an axillary aneurism of this kind thirty years after a shot had taken effect on the spot. Roux * relates a case in which arterio-venous aneurism at the elbow formed four years after venesection; and Monneret † has described an aneurismal communication between the femoral artery and the vein, said to have arisen twelve years after injury from a shot. This was also the case with Mr. Beaumont's patient, p. 526.

Again, spontaneous arterio-venous aneurism has been described by Bransby Cooper,‡ by Perry,§ and Porter,‖ affecting the femoral vessels in cases where the aneurism could not be traced to any other cause than primitive disease and thinning of the coats of the vessels. In the highly interesting case related by Mr. Perry there was more than one communication.

It is usually a main artery, and its collateral vein which are thus affected; and it may be readily understood that, from their close contiguity and often superficial position, these would be more likely to become the subjects of this diseased connection; but the elaborate investigation of M. Follin and Charnal,¶ and the cases of Puydebat** and Pancoast†† have shown that deeply-seated veins, as well as superficial veins, may be thus affected.

In the case of M. Follin, a communication between the brachial artery and a deep vein was diagnosed during life, and subsequently proved by the dissection of M. Charnal. Schottin ‡‡ has seen a similar connection between the radial artery and the cephalic vein. Moore §§ relates a case in which an arterio-venous aneurism was found in the trunk of the popliteal nerve, as a result of a blow on the part, which appears to have produced rupture of a small artery and its companion vein in the substance of the nerve.

These two forms of arterio-venous aneurism have some symptoms in common due to the communication between the artery and vein. The most characteristic is a vibratory thrill, which results from the impulsion of the arterial blood into the patent aperture of the vein, there to mingle with the venous current. The greater tension of the arterial than the venous wall, and the greater force of the arterial flow of blood, causes a continuous injection of arterial blood into the venous tumour; but the pulsation of the artery produces a synchronous impulse in the

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* *Bulletin de l'Acad. de Méd.* Paris, 1849. † *Bulletin de Méd. et de Chir.* [illegible]

‡ *Guy's Hospital Reports*, vol. v. § *Med.-Chir Trans.* vol. xx.

‖ *Todd's Cyclop.* 'Arteries,' p. 242. ¶ *Bulletin de la Soc. de Chir.* vols. [illegible]

** *Bulletin de la Soc. Anat.* 1834. †† Fergusson's *Handbook of Surgery*. [illegible]

‡‡ Schottin, *Merkwürdiger Fall einer aneurismatischen Venengeschwulst.* Altenburg, 1825. §§ *Med.-Chir. Trans.* xlix. p. 29.

of the blood through the tumour. Hence the peculiar
tory or pulsatory character of the thrill, which is other-
continuous. The ear detects a harsh, buzzing sound, which
been variously compared to that of a saw, a file, a bee, the
ng of burning metal plunged into cold water, and similar
s. This sound too is continuous, although momentarily in-
ed during pulsation. It grows fainter on being propagated
g the artery, and at some distance from the aneurism in
h it arises it seems intermittent, the louder pulsatory sound
being then heard. This sound may be so loud as to be
ble by a person standing near the patient; but that is ex-
ional. It may, however, always be distinctly heard with the
oscope, or by the naked ear; and its continuous character
ply distinguishes an arterio-venous from a pure arterial
rism. Considerable dilatation of the veins, a third symp-
, is consequent upon the obstruction of the venous circulation
he entrance of arterial blood flowing in an opposite direction,
upon the general increase thus made to the quantity of blood
h the vein must carry towards the heart. The extent of
dilatation varies according to the size and importance of the
els affected. It is most marked in the lower limbs, where
ity aids in increasing the obstruction and consequent
lency to varicosity. Here the veins have been described
knotted ropes beneath the skin by Porter, Perry, Laugier,
others. In Mr. Moore's case, where the temporal vessels
e affected, the veins were enormously dilated, and pulsated
trongly as entirely to simulate arteries during the operation
ormed.*

his pulsation of the veins is a fourth important symptom
ch deserves to be borne in mind; because the surgeon may
and has been, induced by it to place a ligature round one of
veins, thinking it to be an artery. William Hunter noticed
the arteries below the point of communication beat more
ly than in the healthy body; and naturally, since a part of
ir ordinary supply of blood is directed into the vein. But
symptom is not always observed. The temperature of the
t, and the growth of hair on the skin, are some times aug-
nted below the communication. In old-standing cases, a
arkable condition of dilatation is observed in the arteries
ve the varix. They become enlarged, tortuous, and thinned

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* *Med.-Chir. Trans.* vol. xli. p. 1.

intermediate between the opening of artery
course, important in practice to recognise tl
mark its peculiar symptoms. This circums
tumour will be found of various size and de
the site and duration. It rarely attains, h
derable size. It is affected in the same wa
aneurisms when the artery is compressed a
and the ear detects the blowing sound of an
tion to that rasping bruit described as the r
communication.

In both forms of arterio-venous aneurism
we find a soft, fluctuating, knotted, and imper
subcutaneous tumour. It can be emptied by
tumour itself, or the artery leading to it
pulsations; but these are limited to a ver
swelling at the level of the point of commun
vessels, gradually becoming extinct in the ra
that point. In this it is distinguished fro
cirsoid aneurism, which offers pulsation of e
the whole extent of the tumour; it may be fu
from that affection by the blue or purple co
and by the tortuous dilatation of the ve
Further, to distinguish it from arterial vari
sents so many points of external resemblan
that while in both auscultation detects a lou
ous bruit, this sound is heard over the wh

where this stationary condition exists, surgical interference well be omitted. In Mr. Moore's case, thirty-six years elapsed before any operation was necessary; and Hunter, ghorn, Porter, and indeed all other authorities on this ject, have seen this occur. It is especially the case in the per extremity. In the lower limb, however, the disease may end so greatly as to destroy the use of the limb, or to eaten the destruction of the patient's life by hæmorrhage. the case referred to, as related by Mr. Perry, the Hunterian ture was twice performed, but without effecting the cure of disease. In a case mentioned by Mr. Bransby Cooper, it was sidered necessary to amputate the leg. Should the surgeon be called upon to treat, by operative means, an artery so cted in either of the extremities, he would probably attempt obtain the closure of the arterial aperture by indirect pressure the artery above the communication. The use of direct ssure has rarely been of any good effect. There are, wever, two proceedings which are more promising: the injec- n of coagulating fluids at the site of the disease, applied efully, with the minute precautions necessary for the success that plan; or ligature of the artery above and below its erture of communication. Before employing either method, would probably be desirable to resort to digital or instru- ntal compression, or, if the position allowed, to forcible flexion. t the constant passage of the arterial blood through the ertures, resulting from the arterio-venous communication, d the absence of any defined sac, impede the formation of fibrinous deposit to which these methods owe their success; d cases of aneurismal varix of this form are not very amen- ble to treatment by indirect compression. An interesting se is recorded in the *Proceedings of the Anatomical Society of ris*, for 1858, in which indirect compression having been refully tried, but without success, a ligature was applied by Robert above and below the aperture in the artery. A few es have been recorded of aneurismal varix within the skull.* n one of these, recently, compression was applied over the rotid, but ineffectually; in this case, the internal carotid rtery communicated with the cavernous sinus; and death occurred as the result of profuse hæmorrhage from the no such cases, of course, only the Hunterian ligature is po but where the artery is more accessible, it is obviousl desirable to apply a ligature above and below the disease munication.

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* *Bulletin de la Société anatomique*, vol. xxix. 1859, p. 298, and vol. xxx. p. 178.

The treatment of varicose aneurism is somewhat differ kind; for here a sac intervenes between the artery a vein, but it is similar in principle. Here also direct a direct compression have been largely tried. In genera trials have not been very successful. M. Nélaton, howev succeeded four times in converting a varicose aneurism bend of the elbow into a simple arterial aneurism by direc sure. Cure was then in all cases effected either by ligat compression of the brachial artery.* Digital compression be employed in the simpler cases, not without hope of cu

Should it be necessary to apply the ligature, it is requi reject the method of Hunter in favour of the ancient proc The most simple plan is to lay open the sac, trace it in artery, and having exposed the aperture in the artery, for purpose it is commonly necessary to divide the sac trans on a director, then to apply a ligature above and bel arterial opening. This method is more simple than that has been employed by Roux and Fergusson, who ha deavoured to isolate the artery, and tie it above and without opening the sac at all.† This is the more di that the artery below its point of communication is sma surrounded by veins dilated and closely packed. On th hand, it is free from the objection attaching to the pla described, arising out of the danger of putting two lig close to the sac, and at a point where it is surrounded by veins. In any case the operation is peculiarly liable to two secondary accidents, hæmorrhage and gangrene; h rhage from the part of the artery above the sac wher dilated, thinned, and gives rise to numerous collateral bra and gangrene of the limb below, which perhaps already, the operation, was cold, benumbed, and œdematous. injection of a weak solution of perchloride of iron has ployed by Serres and Jobert,* Velpeau,† and Vallette,‡ twice h perfect success; once producing suppuration of the sac, owed by cure, and once, by M. Velpeau, ineffectually. ese facts are in favour of this method of treatment; and as safeguards against the accident of suppuration are more efully studied, this plan may recommend itself still more ongly to the surgeon.

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* *Journ. de Méd. et Chir. prat.* 1862, p. 155.

† This operation was recently performed successfully by Prof. Spe case of arterio-venous aneurism of the femoral artery. (*Edin. Med. Jour* 1869.)

Galvano-puncture has been employed by Bosse and Capeletti. Bosse's case two steel needles, connected with thirty-two rs of galvanic plates, were introduced into the aneurismal nour, and retained there for eighteen minutes. The cure completed within ten days. In Capeletti's case the needle introduced twice; suppuration followed and ultimately a re. M. Debout has also recorded a successful case.§

There will be cases in which an expectant treatment will be ost advisable, and others in which amputation might be the ly available measure.

Thus a case is reported in the *Journal de Méd. et Chir. pratique* for 1862, 155, under M. Nélaton's care, in which a man was suffering from an arterio-nous aneurism of considerable size in the ham, the result of a punctured wound the popliteal artery. M. Nélaton recommended that no operative measures ould be adopted, believing that the aperture of the aneurism into the vein as sufficiently free to render the bursting of the tumour improbable; and he marked that the only efficient measure for the radical cure of the disease ould be the old operation for aneurism, and this under the circumstances he ld to be so difficult and dangerous, that if driven to operate, he should prefer putation.

Cirsoid Aneurism, and Aneurism by Anastomosis.

By cirsoid aneurism is understood a form of disease which onsists in a simultaneous elongation and dilatation of an artery. The structure of its wall exhibits in the beginning no alteration, lthough the coats become thinned during the progress of the nlargement. It will be observed that this lesion is not strictly included in the terms of the definition which was given of aneurism, and recent authors have agreed that this disease is improperly denominated aneurism. But it seems pr most convenient to describe it here.

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* *Bulletin de l'Acad. de Méd.* 1854.

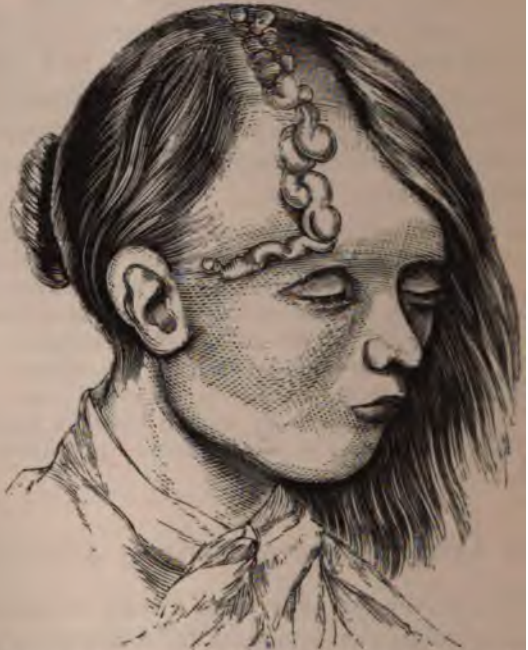
† 'Traitement de l'anévrisme artério-veineux,' *Bulletin de l'Académie de Médecine*, 1854.

‡ *Acad. de Méd. Paris*, May 23, 1859.

§ See Wernher, iii. 821.; Ciniselli, *sulla Elettropuntura nella cura degli Aneurismi*: Cremona, 1856. Debout, *Bulletin de Thérapeutique*, 1847, p. 123.

It is especially the middle coat of the artery which i when the process of thinning commences. This becomes pale, soft, and thin, so that the arteries look veins. The dilatation is commonly equal throug circumference of the artery; but in the more severe artery is greatly dilated, and presents unequal saccula which are, in fact, so many true aneurisms, projecti

FIG. 165.



Cirsoid aneurism of the scalp. (From a drawing in the Museum of S Hospital.)

towards the surface of the skin. As the artery el becomes tortuous and serpentine; sometimes even sp disease is rarely circumscribed, but attacks common trunks and their branches. M. Broca, however, has a case of perfectly circumscribed cirsoid aneurism of treated successfully by the injection of perchloride of may occur in the arteries of the extremity, and Cruve

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[*] *Bulletin de la Société de Chirurgie de Paris*, 1859.

ported a remarkable case of cirsoid aneurism of the external c artery.* But it is more especially frequent in the arteries the scalp, and in this situation more instances have been rded than in all the other parts of the body taken together. ginating usually in one of the arteries of the scalp, it ends itself to the branches of the other side of the head, and y implicate the connected vessels to a variable extent. On the hand, it may pass into the capillaries, widely dilating them, affecting even the terminal veins in its march; or on the er, but in a smaller degree, it may affect by retrogression the ger branches from which the arteries of the scalp arise, pass- g even into the carotids. It is thus that it changes somewhat anatomical characters. The venous capillaries and trunks come affected by the extension of the disease, and the arterial twork becoming highly and morbidly developed, this form is own by the name of *aneurism by anastomosis.* The patholo- ical condition and the principles of treatment are essentially e same; but when the disease is seated in the larger arterial runks, it is commonly known as cirsoid aneurism; when it xtends into the network of capillaries, it is known as aneurism y anastomosis, or racemose aneurism. It attacks most frequently the superficial temporal, the posterior auricular, and the ccipital arteries. Commonly the surrounding tissues suffer but little injury; but sometimes the subcutaneous cellular tissue may be atrophied, and the skin dangerously thinned; at other times the soft parts may be thickened and indurated; sometimes the bones are grooved, or even perforated.

M. Gosselin† has endeavoured to subdivide cirsoid aneurisms nto three classes: arterial varix, when large arteries are affected as in Cruveilhier's case); cirsoid arterial tumour, when the maller arteries are affected, forming a circumscribed lobulated ulsatile tumour; and aneurism by anastomosis, when the apillaries and skin are involved. The distinction is a real one in many cases, and useful to recollect, having an important bearing on practice; but the three forms are too much mixed together to enable us to accept it as a classification of the disease. The second class are those in which coagulating injections, according to M. Gosselin, are likely to succeed; and

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* See also Cocteau, 'Sur les Varices artérielles des membres,' *Arch. gén. de Méd.* 1865, p. 660.

† *Arch. gén de Méd.* 1867.

I would add that in the third class galvano-caustic oı tion are the methods usually indicated.

The causes which give rise to cirsoid aneurism are rent. Occasionally its origin has been referred to a b an injury of a congenital erectile tumour; more often can be assigned, and it is not evident why the scalp the chosen seat of this disease. It may be noticed her majority of cases occur in persons whose age varies fr to thirty. The diagnosis of the disease can hardly be of difficulty, for the serpentine and pulsating charac tumour afford a distinguishing sign. The manner of d this affection from varicose aneurism or aneurismal vari mentioned in the last section. But where it is assoc dilatation of the veins, some difficulty may arise in di ing it from the so-called erectile tumour, or telean from which it is, however, still distinguished by its ı Such cases have been recorded by Pelletan,* by Dı and others.

The treatment of this disease commonly offers g culties and many risks. The frequency with wh failure has followed various procedures, the yet gr quency of relapse, and the occasionally fatal termi operations which have been undertaken, are reasons f in dealing with this disease. Unless there is reas that by its extension or by its severity it may prove f it is commonly the more prudent course to abstain fr tive interference. Cirsoid anastomosing aneurism is ı a source of imminent danger, and it may exist for n without any other evil effect than that of inconvenie indeed, in some of the least unfortunate cases it h tinued after various operations. Even where exte severe, it cannot always be treated with advantage.

The simplest method of treatment is by compressioı is also the most ineffectual. I am not acquainted case in which it has proved successful, although trials recorded by Dupuytren, Robert,‡ and Brodie.§ If pa desired, little more can be done than to provide covering to protect the affected part, where the locali of such a provision. The ligature of the branche leading to the affected part has been often tried; but rarely succeeded. In a case in which Breschet tied the poral artery in a girl eighteen years of age, for a severe form he disease, death from pyæmia took place on the fourteenth ;[*] the ligature having been carried through and not round vessel. Maclachlan tied the temporal artery, also without cess, and followed it by ligature of the common carotid.[†] In atient of Dupuytren's, both the temporal and occipital ries had been tied unsuccessfully.[‡] Gibson in a similar e tied the main branches of the temporal and occipital artery fectually.[§] The records of the results of this proceeding are in its favour.

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* Pelletan, *Clinique chirurgicale*, vol. ii. p. 59. Paris, 1810.

† Dupuytren, *Leçons orales*, vol. v. p. 43. Paris, 1839.

‡ *Gaz. des Hôpitaux*, 1851, p. 130. § *Lancet*, 1828-9, vc

he ligature of the external carotid has been performed for a oid aneurism of the scalp by Maisonneuve.[||]

e tied the right external carotid for a cirsoid aneurism of the right temporal ry occurring in a woman thirty years of age two months after a blow. The ent was suffering acute pain, and the disease beginning rapidly to extend, ides tying the external carotid, he put a ligature also round the superior roid artery. Pulsation ceased, the tumour diminished, and all went well for first three weeks. Secondary hæmorrhage followed the separation of the ature, and Maisonneuve tied successively the common and the internal carotid ries. The latter operation was followed by hemiplegia, and, after three s, by death. The brain substance of the right hemisphere was found to be iquescent. This case had, therefore, a very unfortunate termination; but it worthy of especial note, because it is, perhaps, the only recorded instance in hich the external carotid artery has been tied for cirsoid aneurism of the scalp, because that proceeding would appear on anatomical grounds to be the best culated to arrest the circulation in the part affected.

Prof. Bruns,[¶] who has given great attention to this subject, ints out that the ligature of the external carotids is the proeeding best calculated to cut off the supply of blood to eurisms of the scalp. He urges that the external carotids of oth sides should be ligatured in such cases, and certainly where t is necessary, from repeated local hæmorrhages or threatened upture, to employ serious surgical interference, the ligature of ne, and still more of the two external carotids, would best ffect the diminution in the supply of blood to the arteries in he scalp; for then only the supra-orbital and frontal branches f the internal carotid would remain capable of supplying blood

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[*] Breschet, *Mémoires chirurgicaux sur les différentes espèces d'Anévrismes*, p. 54. Paris. 1834.

[†] *Lancet*, 1827-8, vol. i. p. 773.

[‡] *Leçons orales*, loc. cit.

[§] *Institutes and Practice of Surgery*, vol. i. Philadelphia, 1835.

[||] *Bulletin de la Société de Médecine de Paris*, 1851, vol. i. p. 400.

[¶] *Hanbuch d. pract. Chir.* i. p. 101. Tubingen, 1854.

the superior thyroid branch of the carotid.
might not be unworthy of the consideratio
future cases.

Judging from anatomical data, the ligatur
carotid artery, while it is pregnant with great
fewer advantages than the application of the
to the external carotids. It has, however, bee
least fifteen cases, but its successes have bee
superiority which it possesses over the ligatur
carotid is by shutting off the supply through t
ophthalmic artery; but the large and numero
the carotid of the opposite side continue to
even where a temporary improvement has fol
tion, speedy relapse has occurred, probably
Again, the disturbance of the cerebral circulat
the common carotid has of course its own pec
that out of eighteen cases in which the operati
death occurred under the knife in three in
others terminated fatally; in five an early rel
first improvement; in the tenth case no fina
given; and in only two is it stated that t
improvement. Instances in which the com
been tied for this disease are recorded by
tren,† Kühl,‡ Bush,§ Wardrop,|| Maclachlan,

ther,[*] Mussey,[†] Warren,[‡] Hersche, Kerr, Zeiss, Arend,[§]
ers junior,[||] Mott, Wood,[¶] and Critchett.[**] A proceeding
h has proved so fatal in the hands of surgeons so eminent
t be regarded with great distrust. It is certain that in very
y cases the dangers of this operation must be greater than
e of the disease itself; and when those perils are sur-
nted, its success must still remain a contingency, which
he past has only three times been nominally realised in
teen cases. Attempts have been made to cure cirsoid
urisms by a method conceived after the old proceeding of
yllus for true aneurisms. It has been proposed to lay open
tumour by a stroke of the scalpel, to stuff the arterial
nd with lint, arrest hæmorrhage by firm compression, and
t to the inflammatory exudation thus excited for the
teration of the arterial channel. It is obvious that this
hod could only be applied to those cases of circumscribed
oid aneurism in which the artery forms a limited tumour by
onvolutions, and to cases of limited aneurism by anastomosis.
fe first employed this proceeding for a cirsoid aneurismal
our of the forehead in a boy aged ten.[††] He divided it
ss with a strong scalpel, stuffed the wound quickly with
ric and sponge, and firmly strapped and bandaged the
le. On the following day, as the pressure was slightly
xed, the wound granulated, and when the parts healed there
no pulsation in any part of the solidified tumour. Bell,[‡‡]
ott, and Lawrence,[§§] have succeeded also in curing aneurism
nastomosis, by incising the soft parts, and promoting sup-
ation in the tumour, maintaining meantime compression. It
ld not be reasonable to expect that the obliteration of a single
e artery in a state of cirsoid dilatation could commonly be
sfactorily effected in this way; not only the fear of secondary
norrhage presents itself, but we know that arteries are but
e prone to adhesive inflammation, and that arterial blood is
k to find outlets and make channels for itself. In a case of

Gräfe und Walther's Journal, vol. v.

Amer. Journal of Med. Sciences, 1830. [‡] *Practical Remarks on Tumours.*

Quoted by Wernher, *Handb. der Chir.* vol. iii. p. 806. Giessen, 1855.

Lancet, vol. ii. 1857, pp. 497, 627; vol. i. 1858, pp. 75, 309 (see also below, .541).

New York Journal of Medicine, 1857.

[*] *Statistical Reports Med. Times and Gaz.* vols. xxx. and xxxi.

[†] *Gräfe und Walther's Journal*, vol. xviii. p. 20.

[‡] Bell, *Principles of Surgery.* [§§] Lawrence, *Med.-Chir. Trans.* vol. ix.

truly cirsoid aneurism this proceeding will almost certai fail.

A more efficient means of destroying circumscribed cirs aneurism is to be found in extirpation en masse by the knife by ligature. The latter method was employed by Sir B. Bro with only temporary success in treating a cirsoid and anastom ing arterial tumour of the head of the size of a walnut, w had the characteristic feeling as of a convolution of meande vessels with strong pulsations. The tumour was trans crosswise, and strangulated by four threads in as many The cure was reported at the time to be complete.* B Prescott Hewett mentioned in a lecture at the Royal Coll Surgeons the fact that the disease recurred in this ca that the patient died some years afterwards, death being buted to 'nervous debility.'

Excision of the tumour by the knife has been severa accomplished, and has yielded cures in cases of great

Mussey's † case is one of the most remarkable on record. The young man aged twenty, had on the top of his head a cirsoid a great size. All the arteries of one side of the head were enormou and when the head was shaved, twenty arteries of the size of a were felt which led to the tumour. Ligature of the left comm failed to cure, and the ligature of the right common carotid t later also effected only a temporary improvement. Extirpation w upon; two semilunar incisions being made around the tumour, then peeled off from the pericranium. These incisions were n ally; the arteries wounded being tied at each half-inch: this oc than an hour, and forty ligatures were required. In spite of all there was a great quantity of blood lost, and the patient fell i the wound, however, granulated, and the patient is stated to hav completely.

Gräfe,‡ Gibson,§ Weitzer||, Busch, Warren, and have also employed this method. Mr. Hart employed fully; freezing the tumour and cutting wide of it, so little blood was lost. The difficulties of this method

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* *Med.-Chir. Trans.* 1829, vol. xv. † Loc. cit.

‡ *Gräfe und Walther's Journal,* vol. xiv. p. 639.

§ Op. cit.

|| *Deutsche Klinik,* 1850.

¶ *Gaz. des Hôp.* 1868, p. 153. This author remarks that the incision being carried a little within the tumour, so as to le pieces of the morbid tissue, is rather advantageous; the tissue i the arteries are easily tied in it; it speedily melts away as the purates.

roved very great, and its danger is considerable. The rhage in some of these cases was excessive. But the issue the recorded cases in which it has been undertaken has successful, and excision by the knife has as yet proved a rapid, safe, and successful means of treatment. It is s that great skill and caution are required to carry effect, and in very extensive developments of the disease be inapplicable. It might commonly be prudent to pre-he extirpation of the tumour by the ligature of the main s which feed it; when practising the incisions around the ir, the knife should travel slowly, and the arteries are to d as they are divided. It was by the combination of well-caution and necessary boldness that some of these for-le operations have been brought to a successful issue. soid aneurisms have also been treated by galvano-puncture, no-caustic, and coagulating injection.

case under Nélaton's care, treated by galvano-puncture, the patient was n aged twenty, having a tumour on the forehead, made up of con-l vessels, the coils of which could be clearly distinguished by the touch; arisen two or three months before, after a blow. Two needles, con-with a Bunsen's pile of thirty couples, were passed into the tumour the pulsations were the most violent, and the current was transmitted h them for ten minutes. Next day, consolidation was found to have place where the positive needle had entered, and after some further s the whole tumour had become a hard mass, which was gradually ed.*

case of aneurism by anastomosis of the ear and scalp, in which (as ned above) the common carotid was tied with a fatal result by Mr. s jun., had been previously under the care of Mr. Cutler and Mr. tt Hewett at St. George's Hospital. It was then treated by a combina- the electric cautery, styptics, and ligature of portions of the tumour. The was very satisfactory: all bleeding ceased, the tumour in great part ed away, the ulceration healed, and the greater part of the hypertrophied resumed their natural appearance. The patient remained free from ous symptoms during an interval of three years, when the tumour gradu-turned and bleeding recommenced. Mr. Travers was sent for to see him in untry, and tied the common carotid artery; but the patient died of hæmor- which commenced while the ligature was still on the vessel; a striking of the inefficacy of that method of treatment. Had the case been kept observation, and the original measures repeated from time to time, as fresh h occurred, there is every reason to believe that this man's life would have aved.

application of coagulating injections (perchloride of iron) was made Broca to a circumscribed aneurism of the scalp, consisting of the con-

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* *Bull. de Thér.* tome xlii. p. 354.

volutions of a cirsoid artery. Many precautions were taken t
extravasation of the fluid, and the case is reported as perfec
Another successful case is reported by M. Demarquay, in a larg
anastomosis of the palm of the hand and middle finger, occur
after the blow of a stone. Here the radial and ulnar arteries,
first tied.[†]

M. Gosselin (see p. 535) advocates the use of coagulating in
those cases of the disease to which he wishes to limit the
'arterial cirsoid tumours,' *i.e.* those of limited extent, and form
by the dilatation of minute arteries—not capillaries. He give
one in the leg, one on the forehead, and the other at the root
which this treatment was successfully adopted.

Before quitting the subject of cirsoid aneurism, it may be wel
the disease is said to have occasionally undergone spontaneous cu
was exhibited by Dr. Krackowizer to the New York Patholog
whom this had occurred, at any rate to a great extent; pu
disappeared, and the tumour having become solid and shrivelled
parts; and the continuous rushing noise formerly perceptible
being now inaudible while he was quiet. The patient was fort
age, and the disease had lasted all his life, and had grown to
size, but without pain or hæmorrhage. In the same comm
Krackowizer referred to two other cases as being recorded
Chevalier.[‡]

DISSECTING ANEURISM.

The affection which bears the name of Dissectin
is so seldom recognised during life, and when it is
of treatment falls so much more commonly under the
physician, that a very few words must suffice for its
here. The anatomical lesion consists in a rupture o
nal coats of the artery, by which the blood is allowed t
unnatural channel between the coats of the vessel, pa
course, until finally it passes again through the coa
enter the cavity of the artery again, if its course ha
wards, or falls back into the pericardium if it has m
backwards. Dr. Peacock[§] has shown that a layer of
coat usually is left external to the blood, which i
extravasated into the thickness of this coat, an
shown that the existence of this more resisting mem
fining the blood renders rupture into the pericardi

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[*] *Bull. de la Soc. de Chir. de Paris*, 1866.

[†] *Gaz. des Hôp.* 1868, pp. 117, 126.

[‡] *New Syd. Soc. Biennial Retrospect*, 1865–6, p. 303.

[§] *Contributions to the Pathology of the Heart and Arteries*, 'C
Aneurism.' Edinb. 1849.

lar tissue probable. When the coverings of the blood are g, and the fluid finds a ready passage back into the artery, may be prolonged for a considerable period. In fact, the ptoms referred to the disease have been observed to last for rs. It is not impossible that in some such cases a dissecting urism may pass into a common 'false aneurism.'*

he position of the original rent seems always to be in the a, and generally in the arch, quite close to its origin, though as been known to be situated in the abdominal aorta, even low as its bifurcation. The position of the secondary rupture he inner coats, by which the blood passes back into the cavity the vessel, varies much. A case is mentioned in which the ration extended into the popliteal artery; and in another , in which the primary rent was in the transverse arch, the ndary opening was in the subclavian.

Death occurs soon in all cases where the blood passes out of artery, either into the pericardium or into the surrounding ues; and in most of those in which the blood makes its way ck into the artery. But in the few instances of the latter es in which life has been protracted for years, the unnatural annel running along by the side of the natural artery is lined a smooth membrane resembling epithelium, and thus simu- es a double vessel.

The symptoms of dissecting aneurism are best illustrated a very interesting case reported by Dr. Swayne and Mr. yworth of York,† in which the diagnosis was accurately made ring life, and confirmed by dissection.

In that case, a man aged fifty-one, who had suffered for some time under nptoms referred to diseased heart, with aortic regurgitation (to which gnosis one of his medical attendants, Dr. Latham, had added disease of the ta), was seized suddenly one evening, as he was returning from a day of ne exertion and excitement, with a very severe tearing pain in the chest, tantly followed by a second agonising pain, which seemed to dart from d-sternum down the left of the spinal column, and only to be arrested a few gers'-breadth below and to the left of the umbilicus, at which point of est the patient thought he heard a distinct crack. He lost power in both wer extremities almost immediately, and the pulse became imperceptible in the arteries of the lower limbs. A bellows murmur was heard below and to the left of the umbilicus. The 'tearing' pain recurred, and he then passed into a state of syncope, followed by great exhaustion and distress. Reaction set in next day, with much congestion, greatly relieved by bleeding. He survived about three months, dying of dropsy and hydrothorax. The pulse had recurred feebly in the right femoral artery before death. The diagnosis of dissecting aneurism, originating near the root of the aorta and passing down so far as to compress the true channel of the vessel near its bifurcation, was made at the time of the seizure and confirmed by dissection. A transverse rent was found in the arch of the aorta, just below its three large branches; a clot of blood was impacted near the bifurcation of the artery, obstructing the left common iliac completely and the right partially. The old canal of the aorta seems to have been disused, and the arteries to have communicated with the new channel.*

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* Thus, in a case cited by Dr. Peacock (op. cit. p. 7), where the patient rvived some years; 'the sac commenced at the origin of the aorta, and rminated in a cul-de-sac at the common iliac arteries.' So that nothing ccept its shape and extent would distinguish it from false aneurism.

† *Path. Soc. Trans.* vol. vii. p. 106.

This case will serve to illustrate the usual run of the cases of dissecting aneurisms, though it is rare for the symptoms to be so well marked or so well observed; and therefore the disease is seldom recognised or even guessed at during life. The patient is usually advanced in life, very probably a female, and suffering from hypertrophy or other disease of the heart. The first symptom is a lancinating pain in the chest, corresponding to the seat of rupture followed by syncope; perhaps by pain at the part where the blood re-enters the artery, or where the tumour ceases. And this may be accompanied by the cessation of pulse from impaction of clot in the old channel of the artery, aided by the pressure of the blood in the unnatural channel. This stoppage of the pulse of course causes more or less complete loss of power. In other cases, where the rupture occurs near the heart and the blood falls back into the pericardium, death is sudden. I can add nothing as to the diagnosis of the disease which may not be gathered from the symptoms in the above case. The only case in which I can conceive such an affection becoming the subject of surgical diagnosis, is where loss of power, loss of pulse, and threatening gangrene follow on dissecting aneurism; and the diagnosis lies between this disease and embolism from the more ordinary causes of impacted clot.

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* In this case, Dr. Swayne, after having his attention specially drawn to the fact by Dr. Peacock, distinctly asserts that the extravasation was between the external and middle coats.

NERAL OBSERVATIONS ON THE LIGATURE OF ARTERIES.

in operations for the ligature of arteries that the proceed- of the operating theatre most nearly resemble those of the cting room; and it is in these operations, more than in others, that minute anatomical knowledge is advantageous. re undertaking to tie an artery, the surgeon ought to know eneral course and its relations, and especially the prominent or parts which are to guide him to the position of the el (to serve as rallying points, as the French operators say); ught to have familiarised himself by frequent dissection* the thickness of the parts covering it, and their appearance, r as that can be judged of on the dead body; and, finally, ught to know the usual position of its principal branches, the anastomoses by which the circulation may be expected e restored. It is advisable also to be aware of the leading liarities in course, relations, bifurcation, &c., which the ator may perhaps meet with, and for which he ought to be ared.

aving all these anatomical details clearly present to his d, and being familiar with the various methods by which vessel can be reached, the surgeon will be prepared to adopt t method which seems to him best suited to the case which happens to have before him. It is better, if possible, to avoid part of an artery where large branches are known to come since in such cases the clot that should form in the vessel ing the process of its severance will be absent between the ture and the opening of that branch; and although it is e, as has been shown above,† that the clot is not necessary a preservative against secondary hæmorrhage, inasmuch as e wound in the artery unites by lymph, which seals it, and ts as a barrier to the blood; yet that barrier is certainly

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* So experienced an operator as Sir P. Crampton relates, that before tying e common iliac artery he practised the operation seven times on the dead bject, and says that each time he did so he learned something towards the isfactory performance of the operation.

† See Guthrie's *Comment.* ed. 1855, p. 80; Porter, *On Aneurism*, p. 187; ston Key, in *Guy's Hospital Reports*, vol. i. pp. 65, 66.

one below should be carefully examined wit
Most large arteries run in a sheath of fascia
their accompanying vein. When the lev
reached, great care must be taken in apply
cellular membrane or muscles over the shea
perly divided or drawn aside, that struct
cleaned by scratching with the finger, assist
of a director or silver knife. When the sh
exposed, and the beating of the artery can be
it, a small part of the membrane should be
and divided with the knife held horizont
opening the sac of a strangulated hernia.
the artery must be extended with the poin
aneurism needle,* till a little channel has b
vessel, through which the thread can be ca
care is necessary to use the instruments wi
this stage of the proceeding, on account of
vein. The needle is to be passed under the
away from the vein; *i.e.* the point of the n
between the artery and vein, and brought ou
artery away from the vein.† When the ne
under the artery, the latter should be com
point of the finger and the curve of the ne
that the beating in the tumour is comple
bleeding completely commanded; and to

ing that no other structure has been taken up with the
el. This is the more necessary in cases where the artery, as
the case of the subclavian, lies very deeply, perhaps out of
ht, and touching a large nerve or other important structure.
ome difference of opinion exists about the administration of
roform in operations on arteries. M. Robert[*] advocates
performance of these operations without anæsthetics, but
contrary practice is now universal, and I think rightly so,
his country. Opinions differ also as to the direction in which
incisions may be most advantageously made. Most operators
ke their incisions in the course which the vessels are known
pursue; others prefer an incision which crosses obliquely
course of the vessel. The former plan enables the operator
re clearly to anticipate and recognise the structures succes-
ly exposed; the latter renders him more certain not to miss
vessel altogether, and also enables him more conveniently
nvestigate the parts around, should any anomaly, such as a
h bifurcation of the brachial or femoral artery, render it
essary to search about, without any definite anatomical
ide, for a vessel not usually present.

Large arteries ought not to be tied unless a reasonable pro-
bility exists of the recovery of the patient from an operation
ich must always be grave, and which is far more fatal than
st surgeons appear inclined to admit; but if the disease or
ury admits of no other cure, nothing need be held to be a
mal contra-indication to the operation; not disease of the
cera, not disease of the heart, not even disease of the artery
elf, although it must be allowed that the latter complication
nders the case almost hopeless.[†] But, on the other hand, the
ost mature consideration is requisite to assure the surgeon
at the case is really beyond the reach of other and milder
easures. So much has lately been done to diminish the
rcentage of cases of aneurism which require ligature, that it
ay now be said that the presumption in a case of surgical

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[*] *Conf. de Clinique chir.* Paris, 1860, p. 48.

[†] If the artery on which the operation is performed be found, when exposed, be extensively diseased, four courses are open. In aneurisms of the ex-
emities, the safest course would be to amputate; in a few cases the surgeon
ight resort to acupressure; usually, the operation would be completed; while
metimes the case would be abandoned to nature. Under the head of ligature
the innominate, a remarkable instance of the good result of the latter course
ill be mentioned. The surgeon must rely upon his own judgment.

first, with the head and neck, and proce tremity towards the trunk.*

ANEURISMS IN THE FORE-ARM A

Aneurisms diminish in frequency as the size; hence the disease is very rare in the indeed, is hardly ever seen except as the re was enabled, however, through the kindnes to see a case of aneurism of the upper part among his patients at the Middlesex Hospit as I suppose would usually be the case, the system was diseased, and a loud murmer acc of the heart.†

There is generally little difficulty in diag in the hand or fore-arm, nor in determi simply arterial or arterio-venous. The tr neous aneurism of these arteries would be if the disease could be found in a subject Digital pressure on the artery leading to t tained by the patient himself as long as he days, much reduced the size and pulsation case above mentioned. If this or other form recourse would be had to the Hunterian op the last resort the old operation would pr lty. I have performed it with great ease and success in a nall traumatic aneurism of the superficial palmar arch. A se is referred to on p. 456 (note), where a small aneurism in e palm was successfully extirpated by chloride of zinc.

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* In speaking of the ligature of arteries it has

The arteries of the fore-arm far more often require ligature account of a wound. It is hardly necessary to give minute irections for the performance of such operations as tying the lnar or radial near the wrist. Common sense would suggest keep the tendons intact; and this being done, and care taken avoid mistaking a nerve or piece of fascia for the artery, all he cautions necessary for the operation are exhausted. It is matter of indifference whether the venæ comites are included n the ligature or not.

If the skin is unbroken, as when the radial or ulnar, or both, re tied for a wound in the palm of the hand, it is merely ecessary to make an incision, from an inch to two inches in ngth, between the tendons which accompany the vessel, divide he deep fascia, which is often strengthened by a distinct thin yer over the ulnar artery; and if the tendon of the flexor rpi ulnaris overlaps the vessel (as is usually the case), draw inwards, and then the vessel will be exposed by a little ssection enclosed in its sheath—the radial accompanied erely by a small filament of nerve lying above the fascia, hich probably will not be seen, the ulnar having its nerve on inner side.

The radial can be exposed, if necessary, higher up, by a milar operation; but now the muscular belly of the supinator ngus requires to be drawn outwards, and the position at which e radial nerve lies against the artery (on its outer side in the iddle third of the fore-arm) must be remembered. The dif- erent directions of the fibres of the supinator longus and ronator teres must be borne in mind. Their vertical direc- ion will always distinguish those of the former muscle.

Ligature of the ulnar artery near its origin is a much more ifficult operation. It is only required, as far as I know, in cases of wound. The very commencement of the artery may be exposed fter the division of the bicipital aponeurosis, without cutting hrough any muscular fibres; but the depth of the parts is very onsiderable, and where there is much effusion of blood, it is by o means easy to recognise the wounded vessel, which may be the umeral itself, or either of its branches. In the only case here I ever saw this operation attempted, it was given up and

median nerve is brought into view, cros
without inwards. Then, if it is necessary
vessel, part or the whole of the pronator t
In other cases it may be more convenient
from below, an incision being made from th
muscular and tendinous portions of the
are felt to join, upwards for four inches,
posed as the vessels emerge from beneat
digitorum. If the wound be higher up,
latter muscle, and even of those adjoining
may be pursued from this point. More
will probably follow the division of the
extensive; but this is likely to be transi
a less evil than the loss of the hand. The
be the first of the structures around the art
view.

At *the bend of the elbow* aneurismal s
always traumatic, and generally are of the
If the disease be a simple arterial aneurism
or spontaneous, pressure upon the brachi
resource of the surgeon. Acute flexion
probably succeed, either by itself or as
indirect compression. If these means sh
course, irrespective of any special compli
the brachial artery. The treatment of art
has been discussed above (pp. 530–533); w

e inches in length, along the inner margin of the biceps cle in the middle of the arm; or if that muscle be obscured dema, fat, or imperfect muscularity, then in a line drawn a midway between the two flaps of the axilla to the middle he bend of the elbow. In making this incision, perhaps the lic vein will be seen, and should be avoided. The fascia ing been divided upon a director, the operator comes down ediately to the packet of vessels and nerves. The internal neous and ulnar nerve lie to the inner side of the artery, may or may not come into view; or perhaps the external neous will be seen on the other side of the vessels. The culty of the operation (which is sometimes considerable) sists in recognising and isolating the artery. What renders s more troublesome is, that the artery, besides being closely rounded with other structures, does not always maintain the me relation to them. The median nerve is more commonly ove the artery, and is the first cord seen below the fascia; t occasionally it will be found under the artery. Again, the chial artery may not be the only vessel which requires liga- re, since another considerable vessel may exist in the neigh- urhood (probably a radial artery given off high up, or a vas errans), which will have to be sought;* it is, however, usually nd close to the one first exposed. The veins often encircle e artery with an intricate plexus of anastomosing branches; nce the operation is frequently far less easy than the super- ial position of the vessel would seem at first sight to promise. is true that a little patience and anatomical knowledge will spose of these difficulties; but they should not be forgotten deciding the question of treating an arterio-venous aneurism the bend of the elbow, since, besides the other objections to e Hunterian ligature, it may be said that, as an operation, it ill very likely be found no easier, and perhaps much more ifficult, than the old operation.

Ligature of the brachial artery is usually very successful, as r as the operation itself goes. It is true that in Porta's tatistical table of six hundred cases of ligature of all arteries, en out of sixty-eight cases of ligature of the brachial artery are aid to have died; but in the absence of details we cannot tell hether they died from the effects of the operation. Gangrene s, however, believed to be sometimes a consequence of the

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* See the figure on p. 525.

Axillary aneurism, like popliteal, depends
tion of cases upon injury, more or less seve
the violent movements of the joint near w
injury may, as it seems, vary from complete
to some slight contusion or strain, only appr
In the former case the aneurism is of the
latter of the false, variety. So far there
difference between axillary and popliteal
different anatomy of the parts occasions a g
curability of these affections. The cellular
is so loose and so large, that the tumour m
manageable development before any treatm
that the great advantage which is alwa
aneurism by the condensation of the parts
the commencement of spontaneous cure i
laminated fibrine, is less likely to occur in a
aneurisms; while the growth of the tumour
coagulum in one part, can easily go on in a
the treatment of axillary aneurism the Hu
less likely to be successful, since, instead o
a long and comparatively superficial cour
siderable branches, as the superficial fem
upon which the axillary aneurism is forme
so crowded with large branches, that a l
applied in close promixity to one or other
It is often said that axillary aneurisms

nce or absence of a sac determines this point, and this
ɪwn by the presence or absence of *pulsation*. I venture
with all possible deference to the great authority of
, that in his paper on the subject of axillary aneurism,[*]
e a new impetus to the discussion of the very interest-
ion of the treatment of that affection, this point has
en made sufficiently plain to the reader, although it
been present to the mind of the author. Mr. Syme
s essay with the rather startling avowal that the
which he had been teaching for more than thirty years,
periority of the Hunterian operation to the old mode
g aneurism, is questionable. But the instance upon
supports this assertion is one in which, accurately
there was no aneurism at all. The history of an
the presence of a large and increasing collection of
arterial bruit, and no pulsation, afford as clear evidence
ion of the artery, unaccompanied by the formation of
smal sac, as can be obtained; and in such cases,
they be in the axillary space or the popliteal, the
ı operation may be expected frequently to fail; and
ure resource is to tie both ends of the bleeding vessel.[†]
ituation of the injury will very much modify the treat-
h would be recommended. In the popliteal space the
ion is very difficult and very fatal, while the Hunterian
is easy. On this account, when the popliteal artery
d, the ligature of the femoral artery has been prac-
ugh unsuccessfully.[‡] Amputation is here usually the
urse. But in the axilla, the old operation has
d, in skilful hands, not more difficult than the
f the subclavian; it is possible that it may prove less
l it is certain, if not fatal, to cure the disease, which

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hir. Trans. vol. xliii.

ust not be led away,' says Mr. Erichsen, 'by the term *aneurism*,
een applied to these cases, and not treat such a condition, resulting
or subcutaneous laceration, by the means that we employ with
e management of that disease. In the diffused traumatic aneurism
Mr. Erichsen's term for a ruptured artery]—there is no sac, properly
d hence those changes to which a sac is necessary cannot take
ubt whether there is a case on record, in which the Hunterian
aneurism, applied to the condition now under consideration, has
ed in danger or death to the patient, and in disappointment to the
cience and Art of Surgery, i. 200.

w, Ligature of the Popliteal Artery.

ligature of the subclavian may fail to do. He
effusion of blood in the axilla from accident,
tions of a sac exist, most surgeons would agre
that the ligature of both ends of the injured ves
rational and more promising proceeding th
of the subclavian, if either operation be requi
are formidable operations, difficult to carry o
and even when performed in the most dexter
dangerous to life. In spontaneous aneurism,
aneurism properly so called, *i.e.* in tumours the
are well defined, the pulsation plainly percep
can be emptied by pressure if the circulation
what course should be pursued? Mr. Syme
favour here also of emptying the sac and
above and below it, and has performed the
successfully. Other surgeons would prefer to ti
in spite of the great mortality with which th
been attended.* Perhaps the decision will be b
ing to the circumstances of the individual case.
extend far up, so that the clavicle is much rais
short and fat, the operation on the subclavian
and so difficult that it would be better to
aneurism. In contrary circumstances (*i.e.* whe
triangle is easily accessible and the aneurism b
axilla), the subclavian may be tied with good
The objection to the old operation, which rests
diseased condition of the artery near the tumo
in this situation than in the popliteal space;
the ligature must be placed near the aneurism.

But would not all these affections, viz. ruptu
matic aneurism, and spontaneous aneurism, be
to milder treatment if it were more persever
will strike the reader of most of the cases of axil

ch the details are fully given, how well adapted they seem ave been for the treatment by digital pressure, had that hod been known.* At any rate, if moderate pressure on the ry where it crossès the first rib can be made (as it often can), means of the finger or a pad, so as to control the circulation, surgeon is not doing his duty to his patient if he expose to the risk of a great operation without a careful and ient trial of this safe and often most successful method.† If ect pressure by a pad in the axilla, or by bandaging the arm oss the chest, appears to assist in controlling the pulsation bruit, it may be at the same time employed. Instrumental pression is less easy on account of the shape of the parts, is less likely to be well borne from proximity of the large rves to the subclavian artery; but it might possibly be ad- able to try it in the absence of a sufficient staff of assistants make pressure with the fingers. If these means fail, one or other of the operations above discussed must be performed.

Mr. Syme thus describes the operation which he performed on the case of tured axillary artery on which he first practised the *old operation*: 'Chloro- m having been administered, I made an incision along the outer edge of the rno-mastoid muscle, through the platysma myoides and fascia of the neck, so to allow a finger to be pushed down to the situation where the subclavian ery issues from under the scalenus anticus, and lies upon the first rib. I then ened the tumour, when a tremendous gush of blood showed that the artery s not effectually compressed; but while I plugged the aperture with my nd, Mr. Lister, who assisted me, by a slight movement of his finger, which d been thrust deeply under the upper edge of the tumour and through the ots contained in it, at length succeeded in getting command of the vessel. I en laid the cavity freely open, and with both hands scooped out nearly seven unds of coagulated blood, as was ascertained by measurement. The axillary tery appeared to have been torn across; and as the lower orifice still bled eely, I tied it in the first instance. I next cut through the lesser pectoral

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* See a case described by Pelletan, *Clin. chir.* vol. ii. p. 50. 'By raising the houlder slightly, the subclavian artery could be felt isolated; and by making ven slight pressure with the finger, its pulsation and that of the entire tumour ould be arrested.' So also in Mr. Crossing's case, in *Med.-Chir. Trans.* ol. xvi. p. 344, pressure on the artery as it crossed the rib was easily made; nd the same may be said of Mayo's case, ibid. p. 360; and of Mr. Poland's in ol. lii. of the same *Transactions.* I merely instance these cases among many hers to which the same remark applies.

† Mr. Poland has related a case in which digital pressure was used with ccess in the treatment of a small aneurism of the subclavian artery (*Med.-Chir. rans.* vol. lii.). Here, however, the artery rose much higher in the neck than ual, and was supported on a process of bone, possibly a cervical rib. The esence of such a rib would much facilitate the application of digital pressure the subclavian artery.

muscle, close up to the clavicle; and holding the upper
between my finger and thumb, passed an aneurism-needl
ligature about half-an-inch above the orifice.' *

Mr. Syme adds the important remark, that the extrem
clavicle occasioned by the great effusion in the axilla,
artery so inaccessible from above, facilitated this proceedi
was no doubt the same circumstance, of the great depth at
of the subclavian was situated, which rendered it necessary
over it through the deep cervical fascia before effectual pre
on it; a precaution which ought to be taken in all similar

Ligature of the axillary artery after the Hun
The axillary artery is sometimes, though rarel
operation for aneurism in the arm, the result
This operation has been much decried, on the
the necessary proximity of large branches to th
surely lead to secondary hæmorrhage. We h
above noted, the high authority of Mr. Guthrie
saying that this apprehension is exaggerated.
which the artery lies, and the necessity for cu
mass of muscle to expose it, form another,
powerful, objection to the operation, which seem
ing this, to have been often effected without
Chamberlaine† tied the axillary artery just be
by a horizontal incision parallel to the lower e
commencing about three fingers' breadth from
of the bone, and terminating about an inch fro
'A second incision of about three inches in l
obliquely through the integuments over the
toral muscles, meeting the first nearly in the c
clavicular origin of the pectoralis major was
the bone, and the artery brought into view by
and cellular membrane.' The only difficulty e
passing the needle, in consequence of the dep
and the struggles of the patient. It was accor

Most surgeons would think that the greater room and
ter view of the parts obtained by the division of the muscular
es would be a great advantage, and would therefore prefer
former method.

n both these operations the artery is sought from above;
operation which Mr. Guthrie vehemently condemns.* The
ration which he proposes to substitute is one by which the
ery is sought from below, which would of course be the prefer-
e operation if the lower part of the artery (that below the
toralis minor) is to be operated on, and by which Mr.
thrie says that any part of the artery can be exposed, and
whole vessel traced up to the first rib, if required. An
ision three inches long is to be made over the course of the
ery upwards from the lower edge of the pectoralis major, and
pendicular to the course of its fibres. These having been
ided a full view of the axilla and its contents is obtained.
the operation is done for a wound, the bleeding mouth of
e artery will be seen by relaxing (if necessary) the pressure
ich, in such a case, will have been put on the subclavian.
r. Guthrie says, that 'the finger introduced into the upper
rt of the wound would enable the operator to divide the
ctoralis minor muscle if necessary, or to draw it upwards;
hen the artery, vein or veins, and the plexus of nerves, might
traced up to the first rib without difficulty.' Nevertheless,
any operation on this artery, the large vein which lies in
ont, and to the thoracic side of the vessel (sometimes, as Mr.
uthrie hints, double), the numerous large nerves which sur-
ound it, and the great quantity of branches which are given off
rom the artery, and which again give off large and numerous
essels towards the inner and front parts, where the operation
ust be conducted, will occasionally prove embarrassing to the
ost dexterous operator, though in other cases, as in those
bove referred to, the surgeon may have the good fortune to
scape them.

Of the success of this operation, no sufficient data exist to
nable us to judge; it appears, however, both from published
ases and *à priori* reasoning, that little danger of gangrene
xists if the artery be tied above the origin of the subscapular,
ince that artery anastomoses so freely with branches of a
higher origin (posterior and supra-scapular), that the blood is

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* *Wounds and Injuries of Arteries*, p. 54.

most readily conveyed around the ligature. Secondary hæmorrhage is more to be apprehended, and we may conjecture that diffuse suppuration in the loose cellular tissue of the axilla would often ensue.

I will not detain the reader with any remarks in this place upon the consequences of wounds of the trunk of the axillary artery, as distinguished from those which follow the division of one of its large branches near the trunk. The persistence of pulse at the wrist or in the brachial artery is the main feature in the diagnosis; the extent and the advance of extravasation of blood the circumstance which decides the necessity of cutting down on the wounded vessel.*

Ligature of the subclavian artery in the third part of its course may be thus effected. The patient is to be laid down on the sound side; the arm should be depressed as far as the tumour will allow, in order to draw the clavicle as much as possible out of the way of the artery; the skin of the neck should be pulled down into the chest by the fingers of the operator's left hand, while he makes an incision down to the bone along the prominent part of the clavicle, from the edge of the sterno-mastoid to the trapezius. The skin is now allowed to retract, when the incision will lie above and parallel to the clavicle. In this way the external jugular vein, which here dips below the clavicle, will be avoided, and may be drawn with a blunt hook inwards or outwards (the former will generally be found more convenient) during the rest of the proceedings. If the muscles approach near to each other, the sterno-mastoid ought to be partly cut away from the clavicle.

If the patient be stout, or the clavicle much pushed upwards, so that the artery lies at a great depth, it is advisable to connect the transverse incision with one running upwards from its inner end, and dissect the flap outwards.† The cervical fascia must now be cautiously divided on a director to the extent of the wound, commencing from the outer edge of the sterno-mastoid, when the knife may be laid aside, and the parts separated by means of the finger, assisted by the point of a director or other blunt instrument. The finger of the operator is now passed the 'subclavian triangle,' a small space bounded by the hyoid muscle above, the clavicle below, and the sterno- toid at the inner side. Lying somewhat parallel to, but per than, the sterno-mastoid is the scalenus anticus muscle, ch must always be carefully sought and traced down with fore-finger into the first rib. When the point of the finger laced upon the ridge on which this muscle is inserted into the (and which terminates on the inner border of the bone, in a y perceptible tubercle), the artery will be felt immediately ler the finger. The other structures contained in this triangle two branches of the thyroid axis, the transverse cervical l supra-scapular, the veins accompanying them which empty mselves into the external jugular, the brachial plexus of rves, with some small branches, and finally an absorbent nd. If the transverse cervical artery should be divided, it ll be tied without difficulty. The supra-scapular is usually low the clavicle, and is not seen. It did, however, come into w in Dr. Warren's case,* and it was not without difficulty at he was enabled to avoid it; which, as Dr. Warren remarks, is important to do, both on account of the difficulty that ight be experienced in securing it, and because it is an im- rtant agent in the collateral circulation. Should either of e veins, or even the external jugular, be much in the way, it ay be tied with two ligatures and divided. The gland may be moved without scruple if necessary.† Much care is required separate the artery from the lowest cord of the plexus, which es so close to it that it often derives pulsation from the artery, nd appears to be a part of it. This mistake is more liable to e committed when the artery is so deep as not to be easily rought into view. It is on this account that it is of so much onsequence in these cases to keep the finger carefully on the nterior scalenus muscle, since the artery is more easily recog- ised by its position with respect to that tendon than by any- hing else.

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* See John Bell's *Surgery*, Charles Bell's ed. 1826, vol. i. p. 416.

† Or a flap may be formed by an angular incision projecting beyond the sterno-mastoid muscle, and this flap dissected inwards. (Skey, *Operative Surgery*, 1st ed. p. 220.)

This operation varies much in difficulty. On the dead sub- ect, or in the living when the person is thin and the parts atural, nothing is more easy; on the contrary, when the lavicle is driven upwards, is greatly curved, as in persons ccustomed to manual labour, and the patient stout and mus- ular, it is one of the most difficult of all the operations on arteries. In these latter circumstances, the artery lies at the bottom of a deep cavity liable to be filled with blood oozing from the many small vessels which will probably be divided in such a case, and the parts cannot be distinguished. It is not wonderful, therefore, that such operations occupy much time, and sometimes terminate in disaster. Two successive cases of Dupuytren's are on record;* in one of which everything went on favourably; while in the other the operation occupied an hour and forty-eight minutes, and on the death of the patient, four days afterwards, it was found that the ligature had been thrust through the vessel, and included one of the large nerves of the brachial plexus, along with half the artery. Another accident to which the operation is liable in complicated cases, is an injury of the pleura, or disturbance of the subserous cellular tissue which connects that membrane to the first and second parts of the subclavian artery. Thus, in a case of much difficulty operated on by Dr. Warren in America,† the air rushing into the chest with a whistling sound gave evidence of the infliction of a wound on the pleura. The patient nevertheless recovered. Mr. Aston Key‡ considers that pleurisy and the inflammation of the subserous cellular tissue leading to abscess in the anterior mediastinum will be found to be the most common causes of death in this operation—an opinion which the statistics quoted below go far to support; and points out the necessity that there is, on this account, for not meddling if possible with any part of the vessel except that which lies immediately on the rib, by which means such an injury to the serous membrane or subserous tissue will be avoided.

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* Infra cit.

† See a case by Mr. Crossing, in *Med.-Chir. Trans.* vol. xvi. p. 340.

That ligature of the subclavian artery should be a very fatal operation, when performed for axillary aneurism, will surprise no one who considers the conditions under which it is performed. In the first place, the procedure resembles Anel's operation almost as much as Hunter's.§ Hence suppuration of the sac from loose formation of clot, and secondary hæmorrhage from disease of the artery, may be anticipated. Again, the ligature be placed in the immediate vicinity of large branches. , again, the deficient formation of laminated clot is further ıred by the absence or loose structure of the aneurismal sac, by the want of resistance in the parts which surround it p. 552). For these reasons the sound cure of the disease s probable, and suppuration in the sac far more common in ıry than in other aneurisms; and if to these sources of er, those above noticed, which result from the anatomy of arts, be added, we shall have, I think, a satisfactory extion of the high mortality of the operation.

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* See Quain's *Anatomy*, ed. 1848, vol. i. p. 504.

† *Med.-Chir. Trans.* vol. xxix. p. 32.

‡ *Med.-Chir. Trans.* vol. xiii. p. 8.

§ It differs indeed in principle from Anel's—so far as Anel's method can be said to have any principle; for as the aneurism may be seated below the acromio-thoracic artery, an anastomotic arch may continue the circulation through the sac after operation; but this cannot be calculated on.

orris's table * of the statistics of this operation, sixty-nine cases have llected in which the operation was performed for various causes. The was most disastrous: thirty-six recoveries against thirty-three deaths; a ty little less than what is supposed to prevail after amputation at the nt. The few cases recently operated on in London, and reported in the *l Times and Gazette*,† have turned out still more unfavourably; out of es two only have recovered.‡ Porta's table of the published cases gives a avourable account, since out of seventy-four cases twenty-seven only are ed to have died; but as Norris's and Porta's tables were both published same year, and as the thirty-three deaths in the former table did cer- occur (for the references to all the cases are given), it is clear that Porta have missed some of the fatal cases. On the other hand, it is quite pos- that Porta may have had access to some successful cases which were wn to Norris; but the Italian tables not being accompanied by references, American are, it is impossible to say how many of Porta's seventy-four correspond with Norris's sixty-nine. The most favourable view of the would be that which would assume that Porta had merely missed six out of irty-three fatal cases, and had tabulated all the rest. Now, adding these list would give thirty-three fatal cases out of eighty, a mortality of 41·25 nt. It may safely be said, then, that the average mortality of ligature of bclavian artery for all causes, and in all cases of hospital and private prac- wn and country, taken indiscriminately, is considerably above 40 per cent. to the causes of this mortality, we get no information from Porta; out of irty-three deaths in Norris's table, five were unaccounted for; of the re- g twenty-eight, nine were caused by hæmorrhage, six by gangrene, five by ing or suppuration of the aneurism, five by intra-thoracic inflammation, exhaustion, one by effusion on the brain, and one by 'inflammation.'

ese facts, as well as the theory of the matter, certainly tend hibit ligature of the subclavian artery as one of the least pro- g of all the surgical operations, and must dispose surgeons the method recommended to them by Mr. Syme in any in which that procedure does not appear too dangerous.

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mer. *Journ. Med. Sc.* 1845, vol. x. p. 13. † Vol. ii. 1856; vol. i. 1860.

n interesting case in which both subclavian arteries were successfully an interval of three years, was published by Mr. Furner in *Med.-Chir.* vol. li.

ANEURISM AT THE ROOT OF THE NECK.

This is one of the most formidable diseases which can
the attention of the surgeon; both the diagnosis and tre
are surrounded with difficulties that are usually found i
able. The main cause of this is the proximity of the
It is exceedingly difficult to distinguish whether the
limited to the tumour, or is propagated into it from the
valves; whether the pulsation is limited to the neck, or
also into the thorax; and whether one only of the large
is implicated, or whether others of the great arteries
neighbourhood, or the whole trunk leading from the
may not be diseased and dilated. Then in the treatm
proximity of so great a stream of blood has hitherto pr
the successful application of a ligature upon the innomi
the first part of the subclavian, for the cure of aneurism
above the axilla.* The atheromatous deposit, which ge
when it exists at all in these large arteries, involves thei
calibre to a very great extent, has sometimes even preve
surgeon from tying the artery after he has exposed it;
probability of the existence of this state of the vessel re
always a hazardous matter to attempt an operation.

First, as to diagnosis. The aneurismal nature of the
does not usually admit of any doubt; for though here,
where, malignant tumours springing from the bones ma
pulsation from their own vessels, or tumours of any ki
proximity to the arteries, such sources of ambiguity
common than in other parts of the body. Reference ma
fore be made on the head of diagnosis between aneuris
other tumours, to what has been said in the section o
nosis, and to what follows upon Abdominal Aneurism.
often a matter of great importance and of great diffi
discover whether the aneurism involves the subclavian a
the root of the carotid, or the innominate, or more tha
these vessels, or the aorta by itself, or in conjunction
of its branches. Mr. Wardrop † lays it down as a
which aneurisms of these several arteries may be d
from each other, that when the disease affects the
the carotid, it will present itself first in the small tr
space between the heads of the sterno-mastoid muscle;
when the innominate is the seat of disease, it will gen

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* Except in one case, which will be referred to in the sequel, where
ism was probably traumatic.

† Op. cit. p. 83.

nd on the tracheal, and when the subclavian is affected, on ervical, side of that muscle. These observations can, how- r, only apply to cases seen in the earliest period of the disease; their deceptiveness even in such cases is shown by the fact, t out of the few cases cited by Mr. Wardrop, one* proved to f the innominate artery, which ought, according to his rule, ave been of the subclavian. But though the place of the e external appearance of the aneurism is not decisive as to part of the artery from which it springs, it is a symptom of iderable importance, and should always be carefully noted n it can be clearly ascertained. Another important symptom he character of the pulsation in the branches of the carotid d subclavian. If the pulse in the brachial or radial, or that he upper part of the carotid or the temporal, be materially s on the affected than on the sound side, we have some son for believing the parent trunk (subclavian in one case, rotid in the other) to be affected; and in the opposite circum- nces to be unaffected. But neither conclusion is free from ne uncertainty. The growth of aneurisms in the cellular sue of the mediastinum and root of the neck is so free, that stances have been observed of aneurisms of the arch of the rta causing compression of the subclavian or carotid, without y disease of those vessels; † while on the other hand, if the eurism approaches the tubular shape, the pulse may be un- fected in the branches, though the trunk is extensively diseased. gain, the influence of the anomalous distributions which so ten affect the branches of the aorta is not to be forgotten.‡ ssibly some assistance to the diagnosis may be obtained by careful consideration of the other organs compressed by the mour. Thus pressure on the great veins will lead to lividity, r even a permanently cyanotic condition of the extremity §

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[*] Case of Gordon, p. 104.

[†] See cases by Allan Burns and A. Cooper, in Burns, *On the Surgical Anatomy f the Head and Neck*, pp. 60 et sqq. 1844.

[‡] I have seen a case in which, from other symptoms, there was no difficulty n diagnosing an aneurism of the arch of the aorta; but one circumstance was ifficult to account for, viz. that while the pulse in the right carotid was un- fected, that in the right wrist was imperceptible. After death, that anomalous stribution was found in which the right subclavian is the last branch of the ch. Passing between the aneurism and the spine, it had been compressed, hile the carotid was unaffected.

[§] Wardrop, op. cit. p. 162; Ogle, in *Path. Soc. Trans.* vol. x. p. 103; Bel- gham, *On Diseases of the Heart*, p. 601; Allan Burns, op. cit. p. 68.

(hand and fore-arm, or face and scalp); pressure on the recurr nerve, to laryngeal symptoms; on the phrenic nerve, to sp modic action of the diaphragm; on the trachea, to stridul respiration, &c.; but much caution is necessary in estimat these symptoms, which are common to thoracic aneurisms well as cervical.

It will be seen from this extremely imperfect sketch, h difficult it is to determine, when an aneurism is situated low the root of the neck, what or how great a part of the arterial tu is involved. The importance of a precise diagnosis consists i the fact that four great operations are recommended for such aneurisms, and that their applicability depends entirely on the limitation of the disease. 1. If the subclavian or carotid were alone involved, a ligature applied to the innominate artery would be analogous to the treatment adopted in other parts of the body. 2. If the aneurism were seated far down the subclavian on the right side, it might be possible to tie the first part of the artery itself, as indeed was done by Mr. Liston. 3. If the root of the carotid alone were implicated, a ligature on the distal side of the tumour (known as Brasdor's operation) might prove successful. 4. In aneurism affecting the innominate artery, it has been proposed to extend this method, and tie both the subclavian and carotid; while if the arch of the aorta were diseased, most surgeons would think any operation unjustifiable.

Assuming that the question of performing any of these grave operations is not entertained till a patient trial of judicious medical and dietetic means has been made and failed, and that a thorough examination of the chest has given reasonable assurance of immunity from disease of the heart, lungs, and aorta, I will endeavour to state as succinctly as possible the conclusions to which I have been brought by observing a few cases, and reading the account of a good number.

1. The ligature of the innominate artery is an operation which has hitherto, except in a single case, only precipitated the fatal result impending over the disease, and which appears to afford less prospect of cure than the methods of general treatment which have been above indicated. But if these are obviously insufficient, it may in appropriate cases recommend itself to some surgeons.* It should never be performed, however, unless

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* See below, Ligature of the Innominate Artery. Having regard to the successful issue of Dr. Smyth's case, it becomes a serious question whether the

rtery can clearly be felt healthy behind the sterno-clavicular ;[*] or the tumour is so plainly limited as to afford a very nable hope that it will be found so. In cases of tubular gement of a long tract of artery in the neck, it is worse useless to expose an artery which will probably be found iseased as either to prevent the operator from the attempt e it, or to give way and occasion fatal bleeding within a hours if it is tied.

The ligature of the first part of the right subclavian ty is an operation which cannot be described in more urable terms than that of the innominate, as far as its ts go; but the indications are, perhaps, rather less per- ing, since a clear space ought to exist between the tumour the trachea. Viewing, however, the anatomical difficulties he operation, the doubt that must always exist whether artery will be found healthy enough to unite as firmly as cessary to bear the impact of so great a column of blood, the great liability to secondary hæmorrhage from the neigh- hood of large branches, the operation seems so unpromising most surgeons would prefer the plan by manipulation ted by Sir W. Fergusson, or galvano-puncture, dangerous ncertain as these measures must be allowed to be. If this ation be attempted, the surgeon should take into mature ideration the possibility of securing, at the same time, some e large branches.

Brasdor's operation for securing the artery on the distal of the tumour is applicable, and applicable almost exclu- y, to aneurisms affecting the lower part of the common id artery; in which, from the equality of the radial pulse on wo sides, the distinct limitation of the tumour, the freedom œdema of the arm and hand, and the absence of murmur in orta or subclavian, there is reason to believe that the affec- is confined to the common carotid. In such cases, it would asonable to commence the treatment by applying digital ure to the artery, in the position in which it is intended wards to tie it.

The double distal ligature, *i.e.* the ligature of the sub- an and carotid for aneurism of the innominate artery, has

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d and vertebral should not be secured in the same operation in which the inate is tied. Further experience is necessary on this point.

f the shape of the bones or joints is altered, it is clear that the aneurism in the thorax.

by manipulation, by coagulating injec
puncture, the reader will find sufficient
forming an opinion as to the propriety o
in any given case of aneurism in the nec

Brasdor's method will be found desc
page, together with other operations o
artery. It remains only to describe the
part of the subclavian and on the innomi

In order to secure the *first part of the r*
as in the operation on the innominate, th
to be exposed and traced down to the bifu
incisions and superficial dissection are t
both operations. An incision should be
border of the clavicle, a director pass
border of the sterno-mastoid muscle, a
greater part of the muscle separated fi
clavicle. An incision should also be ma
inner edge of the muscle, and the who
divided muscle should be reflected outwa
and sterno-thyroid muscles now come
drawn aside with a blunt hook, or cut ac
fully the sheath of the carotid vessels—t
on this side inclining away from the art
interval in which the pneumo-gastric ne
now the operator desires to secure the fi
clavian, he must remember that the onl
free from important relations to admit

of the vessels, the subclavian is to be followed outwards the pneumo-gastric nerve is recognised by the finger. The ture will then be most readily passed with a probe curved ptly, or a needle more bent than usual, introduced from ore backwards.

If, on the contrary, *the innominate* is to be tied, the operator t follow down the line of the carotid artery into the thorax, en he will find the end of the vessel behind the sterno-vicular joint, and must get the ligature round it as best he —perhaps the most difficult part of the whole operation, ce great veins lie close to the artery, the slightest wound of hich may give rise to fatal hæmorrhage, and the parts are obably quite out of sight.

On the dead subject, the innominate may be reached without y such extensive dissection, by exposing the root of the achea with a sufficient incision, and running the finger down into the thorax, where the artery will be felt crossing the r-tube obliquely; but in the living body I should think the eater freedom and better view of the parts obtained by the vision of the muscles at the root of the neck would render the eration above described preferable.*

The innominate has also been reached from the front, by moving the end of the sternum and the sternal end of the avicle. Two cases were operated on after this manner by Dr. oper of San Francisco,† the aneurism affecting in both cases e carotid and subclavian arteries, while in one at least the end the innominate itself was diseased. The first patient died a w days after the operation, his death being hastened, it is said, disease of one kidney. In the second case hæmorrhage had curred, but the patient was going on well, when he tore off e bandages from his wound, with the intention of destroying mself, and perished of hæmorrhage on the thirty-fourth day.‡

The innominate artery has now been tied more than a dozen times. Mr. richsen tabulates thirteen cases, including the last published case under the

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[*] It is usual in speaking of the ligature of the innominate artery to describe rious contrivances for carrying a ligature round it. I have not found on the ad subject that they are superior to the simple aneurism-needle, nor have I en any case in which they have been used on the living. Mr. Syme, in speaking the ligature of the common iliac artery, says that, in his judgment, 'the nplest form of needle is the best' (*Obs. in Clinical Surgery*, p. 169).

[†] *Amer. Journ. of Med. Sc.* Oct. 1859.

[‡] Erichsen, *Science and Art of Surgery*, ii. 8.

away, even against some resistance.' The tendency
in check for more than a month by the compression c
with great violence. The vertebral artery was then
by marked decrease in the circulation of the ar
became occluded. The radial pulse, however, retur
went well after this last operation, and the patient at
months after operation) was perfectly well, except t
regained the use of his arm.

In four cases the artery has been exposed, but
operator has not dared to tie it. In one of these c
afterwards underwent a spontaneous cure.

A case is reported in vol. xix. of the *Bulletin d*
p. 454, in which M. Peixoto of Brazil, is said to ha
a 'ligature d'attente,' removed on the twelfth day
erectile tumour of the ear, coming on before the se
had been placed on the common carotid. The p
There is no proof, however (as M. Velpeau, the
observes), either that the innominate was really t
ligature might have been placed under the root of t
was obliterated.

A case should also be referred to, under the care c
which acupressure was used to the axillary artery,
the innominate, by means of a screw instrument
resembling an ordinary aneurism-needle, and the
down on to the former. This was kept for three
then removed. Pulsation immediately returned
afterwards burst, and the patient died.

The operation on the first part of th
hitherto uniformly fatal. Eleven cases
cause of death was hæmorrhage in every

n's cases, to endeavour to guard his patient from secondary
orrhage by tying the carotid and vertebral at the same
. But it must always remain in the highest degree doubt-
whether such an operation would not be more dangerous
than the disease it is intended to cure. Sir W. Fergusson
proposed to treat aneurism at the root of the neck which
its less heroic measures, by amputating at the shoulder-
, trusting that the (distal) ligature of the axillary artery
e face of the stump would cure the aneurism now that the
is removed, and so no need exists for a collateral circula-
. The only published case in which this operation has been
d is Mr. Spence's, which is added to Mr. Poland's paper on
rect digital compression for the cure of subclavian aneurism
.-*Chir. Trans.* vol lii. p. 306). In that case the limb was
atened with gangrene, which made the indication for ampu-
on more plain than it would have been in any ordinary case.
patient survived the operation about four years; the cause
death was not exactly known, but it appears to have been due
the growth of the aneurism. The latter was of the tubular
iety. It diminished in size after the amputation, but there
no proof of any coagulation of its contents. The operation
t be a most dangerous one to a patient labouring under
ase of the great vessels, and the cure of the disease by it
hly doubtful. In one case (referred to on p. 555, note), subcla-
n aneurism has been successfully treated by digital pressure
ve the tumour, but there were peculiar anatomical conditions
hat case which cannot be expected to be again met with.

igature of the *vertebral artery* was performed by Dr. Smyth
New Orleans, for secondary hæmorrhage, in the case of
ture of the innominate and carotid above mentioned. The
ration is performed in the following manner.*

he head of the patient being thrown backwards and turned slightly to the
an incision two inches long was made from a little above the clavicle along
posterior border of the sterno-mastoid muscle. The edge of this muscle
ng been exposed and drawn aside, the prominent anterior tubercle of the
sverse process of the sixth cervical vertebra was readily felt, and taken for
ide—the artery lying vertically below it. A layer of fascia was divided,
e loose cellular tissue with lymphatics and the ascending cervical artery
e pulled to the inner side; the scalenus anticus and longus colli muscle
e separated from each other close below their insertion into the tubercle,
n the artery and vein became visible. The vein was drawn to the outer

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This method of operating will be found described in Mott's *Velpeau*, vol. ii.
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side (a point of importance according to Dr. Smyth), and the needle was passed round the artery from without inwards. Dr. Smyth remarks that when the artery enters the foramen in the fifth transverse process, it is more readily found. In one case which he dissected he found it entering the foramen of the seventh vertebra. In Dr. Smyth's case the operation was much facilitated by the empty condition of the vessels consequent on the previous hæmorrhage.

Dr. Parker of New York also tied the vertebral artery simultaneously with the carotid and subclavian (its first part) in a case of subclavian aneurism. The patient died of hæmorrhage, and on post-mortem examination it was found that both the central end of the subclavian and that of the vertebral were opened by ulceration.*

Brasdor's Method of Treating Aneurism.

Brasdor was, it is said, the first to propose the operation which has ever since gone by his name, viz. the ligature of an artery affected by aneurism on the distal side of the tumour, or that farthest from the heart, instead of the usual plan of tying it between the heart and the tumour. Brasdor, however, has left no written account of his proposition, nor did he ever put it in practice. It was renewed by Desault, and he has left us a notice of it in his works.† The first person to act upon the suggestion was Deschamps, in a case of femoral aneurism; but his operation was undertaken on such mistaken principles, and was conducted so unsuccessfully, that little use can be made of it. Sir Astley Cooper‡ tied the femoral artery below an aneurism in the groin, which appeared to him to have extended so far up as to render the application of a ligature above the tumour impracticable. It seems, however, from the terms in which this operation is spoken of, that it was only intended as a temporary expedient, and that Sir A. Cooper expected from it merely such a diminution in the size of the tumour as would render it afterwards possible to apply a ligature in the ordinary way. In this he was disappointed, for the tumour continued to extend upwards, and burst under the peritonæum.

With the resources that modern surgery possesses, and it may be added, with the knowledge we now possess of the very grave dangers attending on ligature of the large vessels, such operations as those above alluded to would be universally rep ted. There is no such reasonable probability of curing an urism of any large artery of the limbs by distal ligature as uld justify a surgeon in exposing his patient to the risk of s operation.

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* *Am. Med. Times*, March 5, 1864; *Am. Journ. Med. Sc.* 1864, p. 562.

† *Œuvres chir.* vol. ii. p. 568.

‡ Hodgson, op. cit. p. 301. Mr. James of Exeter performed a similar operation on the patient in whom he afterwards secured the aorta, and attributed to the distal ligature of the femoral a certain amount of diminution of the tumour. —*Med.-Chir. Trans.* vol. xvi. p. 1.

There is, however, one situation in which the operation has en successfully performed, and in which it will be perfectly tifiable to repeat it, at least until some more certain and safe ans of cure can be suggested; viz. in aneurisms of the carotid tery at the root of the neck. Mr. Wardrop* was the first to ow the practicability of this proceeding; and he operated ccessfully on a carotid aneurism of recent origin in a lady ed seventy-five. To him also must be conceded the merit of owing the difference in principle between the operation as actised upon the carotid and upon the arteries of the limbs. he difference depends simply upon the fact that no branches re given off by the carotid artery in any part of its course; so at, for this purpose, the whole of the vessel may be regarded part of the aneurismal sac, and a barrier at any part of the tery will stop the circulation through the tumour. This at st is the case if the aneurism be not situated so near to the bclavian (on the right side) as to share in the circulation of at vessel; but such a tumour would be almost as much an eurism of the subclavian as of the carotid. On account of his ccess in this instance, and his work written to recommend is form of operation,† Mr. Wardrop's name is frequently sociated with the method of distal ligature.

Wardrop pointed out plainly the difference in the method of rasdor as applied to carotid and other aneurisms—viz. that in he former no branch intervenes between the aneurism and the gature; and he related four cases of carotid aneurism so treated, proving indisputably,' as he said, 'that the future growth of an neurismal tumour may be arrested, and its parietes consolidated, y placing a ligature on an artery on the *distal* side of the sac, hen no branch intervenes between the sac and the ligature' p. cit. p. 53). He goes on from this point, which he believes mself to have demonstrated, and the demonstration of which I think quite satisfactory, to state that in his opinion the me method may also be pursued in cases where the artery is ferently situated, *i.e.* where branches do intervene between the eurism of the ligature, as in the cases where the carotid artery

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* *Med.-Chir. Trans.* vol. xiii. p. 217.

† *On Aneurism.* London, 1828.

alone, or the subclavian and carotid simultaneously, are t
aneurism of the innominate. But here I cannot think Mr
drop's facts or reasonings are at all conclusive. He gives o
(that of Mrs. Denmark) in which he tied the subclavian
for innominate aneurism, the carotid being so compress
he judged it to be impervious, which, however, it was no
patient survived some time, and evidently derived bene
the operation, but the disease seems not to have bee
cured. Mr. Wardrop also mentions the case operate
Mr. Evans of Belper, by ligature of the carotid alone, i
the symptoms of impaction of clot in the subclavian arte
very obvious (see below, p. 578).

In the *American Journal of the Medical Sciences*, vol. xiv. p. 22, wil
a table by Dr. Norris of fifteen cases in which the carotid artery w
Brasdor's principle.* Of these fifteen, four are admitted to have di
immediate effects of the operation: and to this number the third c
table † ought certainly to be added, and perhaps the sixth also. At
we shall probably not err much in representing the mortality of
operation on the carotid artery at one-third of the number of cases
fifteen cases, four only are said to have been cured by the operatio
them appear to have been aneurisms of the carotid, unless one s
excepted (No. 5), in which the innominate was thought to be affecte
this case recovered, the diagnosis was of course not absolutely c
Dr. C. Pilz has given a table of thirty-eight cases, in which, accordi
classification, the carotid artery has been tied on Brasdor's method.
the value of that table will be found to be much diminished by the
Dr. Pilz has mixed together cases in which the ligature of the caroti
main operation, and which were performed strictly on the principles
by Wardrop, with others in which (as in Liston's and Smyth's cases)
operation was the ligature of the trunk between the tumour and heart
of the carotid was merely a precaution against the reflux current. N
Pilz's collection by any means free from errors. Out of the thirty-e
twelve only recovered, twenty-five died, and in one the issue was unc
careful examination of Dr. Pilz's table will, I think, convince any p
the reality of cure or even of improvement, in many of the twelve ca
recovered from the operation, is not only not proved, but is highly im
I refer especially to the cases marked 553, 559, 564, 566, 583, 586. I
these statistics as being correct, which we are obliged to do in the wa

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* Of which six were for aneurism, supposed to affect the carotid onl
remainder, the innominate was thought to be the seat of the disease,
is plain, from the dissection of cases in which death took place, that in
least the arch of the aorta was diseased.

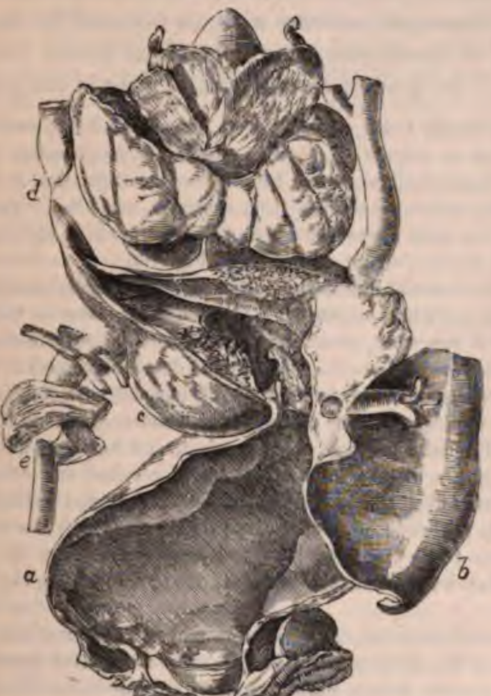
† Mr. Lambert's, quoted from Wardrop, *On Aneurism*.

‡ The last case operated on in London was under the care of Mr. La
operation was unsuccessful, as the aneurism burst into the lung.—
Surg. Dict. 8th ed. 1861, vol. i. p. 215.

xperience, it is abundantly plain that the risk of the operation is anced by a rational probability of success only when the aneurism is on the carotid itself, and does not share in the pulsation of the . The above amount of success is, however, quite enough to justify on of the method in any such case, where the attempt to tie the Hunter's principle would be impracticable or even attended with nger.

ircumstance, which seems to occur pretty generally not universally in these cases, testifies very strongly to

FIG. 166.



from the case in which Mr. Fearn of Derby tied the carotid and subclavian s for innominate aneurism. (From the preparation in the Museum of the College of Surgeons.) *a.* The root of the aorta. *b.* The dilated portion of ch divided. A portion of the inner wall of the artery is seen above, in a nt light, with the left subclavian artery opening out of it. *c.* The aneurism ing the whole length of the innominate artery, almost entirely filled with agulum, through which, however, a channel is left about equal to that of tural artery. A portion of clot is seen projecting through the mouth of the sm into the aorta. *d*, *e*. The carotid and subclavian arteries at the seat of e.

ity of the efforts of nature to cure the disease. It is, pulsation in the tumour is usually not increased, but, on the contrary, often much diminished, by the ligature of the vessel beyond it. In almost all the cases related in Mr. Wardrop's book, the tumour was observed to diminish both in size and pulsation immediately after the operation; a result which could only have been due to the rapid increase in size of the branches below the tumour, by which the course of the stream of blood was diverted from the aneurism.

Aneurism of the innominate artery and other aneurisms at the root of the neck have also been treated by the distal ligature, sometimes of the carotid and subclavian simultaneously, at others of the same arteries with an interval between the two operations; of the former, four operations are on record, of the latter three. In each class one case of cure is claimed.

Mr. Fearn of Derby * tied the carotid on August 30, 1836, and the third part of the subclavian on August 30, 1838, on account of an aneurism of the innominate artery. The patient recovered from both operations, and died four months after the ligature of the subclavian, from a cause unconnected with the operation or the disease. I append a representation of the parts, which are preserved in the Museum of the Royal College of Surgeons (Fig. 166).

It is impossible to doubt that in this case a cure temporarily at any rate has been produced by the operations employed. The doubt expressed on that point in the former edition of this work, resulted from a little ambiguity in the original description of the preparation. As the patient's death happened so soon after the apparent cure of the aneurism, it is impossible to speak with confidence as to the probability of a recurrence; such recurrence is of course always to be apprehended when a channel remains through the aneurism, and has been noticed after the apparent cure of the disease in many cases of cervical and other aneurisms. But this does not affect the main fact, which is, that the patient's symptoms were completely relieved; and especially (a point to which I would call particular attention) that the growth of the aneurism against the trachea was stopped. I think we are entitled to reckon Mr. Fearn's case, therefore, as one of cure.

Another and still more interesting case in which temporary cure resulted, was under the care of Mr. Christopher Heath, who tied the third part of the subclavian and the carotid artery, simultaneously on November 21, 1865, for an aneurism believed to be innominate.† The patient was a woman aged thirty. I have not space to describe the symptoms. It will be sufficient to say that she had had hæmoptysis, was greatly distressed by dyspnœa, and there was also some dysphagia. The diagnosis was a good deal debated at the time. Some surgeons thought the disease a pulsating cancerous tumour of the bones; others (and myself among the number) were rather inclined to believe it to be a thoracic aneurism involving the aorta and innominate. Mr. Heath inclined to the belief that the affection was purely innominate. The operation was followed by great

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* Fearn, *Lancet*, 1836–7, vol. i. p. 129; 1837–8, vol. ii. p. 763; and 1838, vol. i. p. 437. See also *Path. Trans.* vol. xviii. p. 42.

† See *Lancet*, January 5, 1867.

ident relief to the breathing, and the tumour diminished in size, allowing a
tion which existed in the sternum, but had been previously imperceptible,
e into view. The patient survived the operation four years; but the
r never ceased to pulsate, and she died ultimately of its rupture ex-
lly through an aperture in the upper part of the sternum involving the
sterno-clavicular joint.

e parts are in the Museum of the Royal College of Surgeons, and they
a bilocular aneurism of the aorta, the innominate being hardly if at all
ted.*

this case the benefit from the operation, and the consequent prolongation
e patient's life, were too decided to admit of any doubt, and I think
h abundant justification for the treatment employed, in spite of an error in
osis, which I believe to have been inevitable. The improvement obtained
ld no doubt have been more permanent had the patient's habits been
ent; but she was a woman of most irregular life, and after the operation,
been brought in a state of intoxication into nearly every hospital and
house infirmary in her part of London. Here, as in Mr. Fearn's case, the
f of the dyspnœa is a very striking fact.

e following is a brief abstract of an interesting case, hitherto unpublished,
stal ligature of the subclavian for innominate aneurism. The operation
performed by M. Broca. I am indebted for the case to Mr. Heath, to
m the notes were sent by M. Broca.

he patient was a man aged fifty, who had had a pulsating tumour above the
t clavicle for about a year. The sterno-clavicular joint on that side was
royed, so that the clavicle was movable on the sternum. The disease had
diagnosed as an aortic aneurism, and he had been for some time in an
m for incurables. He was then transferred into a surgical ward by one of
'internes' who wished to study the case, and thus came under M Broca's
rvation. He then had a fit, accompanied by convulsions on the left side,
culty in speech, loss of memory and of general mental power, and violence.
s lasted twelve days. When M. Broca examined him he found the pulse
nt from the right carotid artery and its branches, and the pulse in the right
ial artery, when examined by the sphygmograph, showed considerable modi-
tion, while the left radial pulse was almost normal. From these circum-
nces M. Broca was led to conclude that the aneurism was not of the aorta,
of the innominate, and determined to tie the subclavian beyond the
leni, judging that the carotid was already closed by impacted clot. At this
e there was noisy breathing and much dysphagia, from pressure on the
chea and oesophagus. The operation was performed on August 25 or 26,
62. On the following day, the patient was able to breathe and swallow
dily, the pulsation was already less violent, and what was very curious, the
uit de soufflet, which before the operation was with the first sound of the heart,
s now with the second. The ligature came away on the twentieth day, and
e wound gradually closed. After his recovery, the tumour still continued to
lsate, and was of about the same size; but it felt much more solid, and the
lsation was neither so powerful nor so superficial. The general health was
rfect, and the cerebral symptoms quite disappeared. He went on perfectly
ll till February 1863, when he was readmitted with gangrene of the left

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* *Path. Soc. Trans.* vol. xxi.

lung, of which he died. Up to the time of his death, the aneurism r in the same condition. The pulse had never returned in the carotid branches. On post-mortem examination the carotid was found perv reduced in diameter and flattened by pressure. The middle cerebral art plugged. The aorta was dilated to one-fourth more than its common The aneurism occupied the whole length of the innominate artery, 'co cating with the aorta by an opening about four centimetres in size' (more than an inch in diameter). The tumour enclosed an enormous clot, in the centre of which was a cavity of the size of a small egg. cavity communicated with the carotid by an oblique and flattened openi on the outer side with the subclavian. The latter artery had its normal c but all its branches were much dilated. The bones of the thorax had extensively eroded, and had at one time evidently been bathed in the blo the aneurism. This, however, had not prevented the formation of fibr clot. Here again I would remark the immediate relief of dyspnœa w followed on the operation.

In order to provide the reader with proper data for formi a judgment on the important question of the advisability of th treatment of cervical aneurism by the distal ligature, I appen in addition to the above cases, the following list of references t the published cases of these operations, for which I am agai indebted to Mr. Heath's kindness.

TABLE OF CASES OF DISTAL LIGATURE FOR ANEURISMS AT THE ROOT OF THE NECK.

I. *Aneurism of the Innominate, treated by Ligature of third part of Subclavia*

1. Wardrop, 1827. Died two years afterwards. Wardrop, *On Aneuris*
2. Broca, 1862. Died six months afterwards. Referred to in text.

II. *Aneurism of the Innominate, treated by Ligature of the first part of Axilla*

Laugier, 1834. Died one month afterwards. *Lancet*, vol. i. 1834, p.

III. *Aneurism of the Innominate, treated by Ligature of right Common Carot*

1. Evans, 1828. Recovered. Wardrop, *On Aneurism.*
2. Mott, 1829. Died seven months afterwards. Mott's *Velpeau.*
3. Aston Key, 1830. Died in a few hours. *Med. Gaz.* vol. vi. Guthr *Arteries.*
4. Case reported by Neumeister, 1830. Died five days afterwards. H *Dublin Quarterly Journal*, February 1852.
5. Morrison, 1832. Died one year and eight months afterwards. *Am. Jo Med. Sc.* xix. 329.
6. John Scott. Died. *Lancet*, 1834–5, i. 893.
7. Dohlhoff, 1837. Died sixth day. Broca, *On Aneurism*, p. 632. Brit. F vol. li. p. 529, 1838.
8. Fergusson, 1841. Died seven days afterwards. *Lond. and Edin. Jo* 1841, vol. i. p. 786.

rta, 1842. Died forty hours afterwards. Porta, *Alt. patol. delle Art.* p. 35.

tton, 1842. Died sixty-six days afterwards. *Dublin Journal,* vol. xxv. p. 490.

rdebo, 1843 (?) Died twenty-one days afterwards. *Arch. gén. de Méd.* 1847, p. 547.

mpbell, 1844. Died nineteenth day. *Lond. and Edin. Journ.* 1845.

ight, 1855. Died sixty days afterwards. *Montreal Med. Chron.* April 1856.

dile of Naples. Died.*

ddinell Hewson, 1867. Died twelve days afterwards. *Pennsylvania Hospital Reports,* vol. i. 1868.

Aneurism of the Innominate treated by double consecutive Distal Ligature.

arn. Carotid, August 30, 1836; subclavian, third part, August 2, 1838. Died four months after the last operation. *Lancet,* 1837, 8, 9.

Wickham. Carotid, September 25, 1859; subclavian, third part, December 3, 1839. Died. *Lancet,* 1839; *Med.-Chir. Trans.* 1840.

Malgaigne. Carotid, March, 1845; axillary, first part, October 17, 1845. Died. *Bull. de la Soc. Anat.* 1848, vol. xxiii. p. 291.

Aneurism, supposed to be of the Innominate, treated by double simultaneous Distal Ligature.

Rossi, 1843. Carotid and first part of subclavian. Died. *Gaz. méd.* 1844, p. 58; Broca, *On Aneurism.*

Cuvellier, 1859. Carotid and third part of subclavian. Died. Demme, *Spec. Chir. d. Schusswunden,* p. 210.

Heath, 1865. Carotid and third part of subclavian; survived four years. *Lancet,* January 5, 1867, referred to in text.

Hutchinson of Brooklyn, 1866. Carotid and third part of subclavian (the subclavian is said not to have been really tied; Erichsen, *Sc. and Art of Surgery,* vol. ii. p. 59). Recovered from the operation, but died from suffocation on the forty-first day. *Brit. Med. Journ.* March 30, 1867.

Maunder, 1867. Carotid and third part of subclavian. Died. *Path. Soc. Trans.* xix. 93.

Sands of New York, 1868. Carotid and third part of subclavian. Recovered from the operation. Disease not cured. *Am. Journ. Med. Sc.* April 1869, p. 568.

n. In this class, the nature of the cases varied considerably. Rossi's and Hutchinson's were really innominate; Cuvellier's was subclavian; Heath's and Maunder's were aortic; Sands' remains uncertain.

VI. *Aneurism of right Carotid, treated by Distal Ligature.*

Wardrop, 1825. Recovered. Wardrop, *On Aneurism.*†

Lambert, 1826. Died. Wardrop, *On Aneurism.*

Bush, 1827. Recovered. Wardrop, *On Aneurism.*

Lane, 1852. Died. Art. 'Aneurism,' Cooper's *Surg. Dict.* 8th edition, vol. i. p. 215.

This operation was performed about the year 1859, and was communicated e verbally by the operator.

Wardrop claims to have tied the carotid in a second case of this nature, as the artery was found completely pervious after death, and with no of ligature, it is probable that a mistake was made in the operation. The is therefore not reckoned here.

Injection.

Pétrequin, 1853. Died. Broca, p. 419, *Gaz. hebd*

X. *Aneurism of Subclavian treated by Ligatu*

Butcher, 1863. Died fourth day. Butcher, *Op. S*

XI. *Aneurisms in which the Carotid was tied, and wh*

1. Tillanus. Lived five months. Velpeau, *Méd. Opé*
2. Rigen, 1829. Lived three months. Died of hernia
3. O'Shaughnessy. Died seven days afterwards. Galv
   Med. Press, October 5, 1842.
4. Knowles, 1867. Died of apoplexy. *Lancet,* June

If now it is necessary to express an opi
which must be allowed to be hardly ripe as
judgment, I would say that I entertain no
priety of performing what I have been in the
as peculiarly Wardrop's operation—viz. the
the carotid artery in aneurism involving o
carotid. This operation Wardrop himself
duced others to perform, and (in the passage
he clearly showed that it could be practis
prospect of cure in aneurisms where there
between the tumour and the ligature. War
associated with the other method of applyin
viz. that where one or more branches do int
tumour and the ligature, but in my opinio
He did indeed suggest the plan, and in one
an operation somewhat on this principle; b
imperfect; for, though Wardrop saw the ne

adopted (copious venesection and antiphlogosis); in Evans's apparent cure was probably due to impaction of clot; and Broca's there was amendment, but certainly no cure. In the other cases in which one artery only has been tied, I not see that any good has been done.

There remains the question of double distal ligature. Here, ain, I think there is no decisive proof of permanent cure, but rn's and Heath's cases, were, to say the least of it, highly couraging; the latter even showing that in aortic aneurism e operation may not be inapplicable—though I would hardly ke it on myself to recommend such a proceeding in a case of eurism known to be aortic. My opinion on this matter is, fact, exactly as it is here stated from the report of the bate at the Royal Med. and Chir. Soc., on the reading Mr. Heath's case there:*—'Considering the great diffi- ty of diagnosis, the risk of finding the arteries diseased here exposed for operation, the great likelihood of serious ease in the aorta or even the heart also; and the possibility spontaneous cure, or cure by appropriate regimen, it seems dent not to undertake these operations without the gravest ideration, and in circumstances which can but rarely present mselves. Perhaps the best indication for operation would the relative amount of pressure on the trachea compared h that of the general symptoms. That is, when the patient otherwise in moderately good health, but suffers much from pnœa, and appears likely to die soon from rupture of the eurism in this direction, the question of arresting it by ligare of the arteries of the right side might be considered, but any case it must be regarded rather as palliative than as rative.'

Old operation for carotid aneurism.—The treatment of aneur- m at the root of the neck, at least when it follows a wound, s been lately successfully carried out by Mr. Syme on the old thod, by laying open the tumour and searching for both ends the vessel. An abridged account of this daring operation is pended; the reader, however, can have no idea of the risks d difficulties of such a proceeding without perusing the fuller ount in the original, and even then his idea will be but a nt and imperfect one.

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* *Lancet*, Jan. 5, 1867.

The operation performed by Mr. Syme may be thus summaril
The patient had been stabbed in the root of the neck about two
and an aneurism had formed, connected with the lower part of the
carotid. This had been advancing rapidly, under compression
tumour, so that it was necessary to do something. Mr. Syme
opening into the pulsating tumour with a bistoury, and then passe
so as to plug the puncture, and felt about till he got upon the sp
sure controlled the pulsation, and where, therefore, the opening
this point firmly compressed, he laid the sac freely open, and sp
clots. A smooth serous surface was exposed, with no trace of
The skin and sternal portion of the sterno-mastoid having now be
a transverse incision (pressure being still kept upon the opening wi
the edge of the slit in the artery which lay under the finger was
catch-forceps, and the vessel drawn towards the trachea; it was
scratched with a knife, till the arterial coat was brought into view on
edge, and a ligature passed round it above the aperture. The sam
was repeated below the opening; and now the finger could be with
out the tremendous gush of blood which had before followed its dis

It is clear that such an operation as this can be su
performed (that is to say, performed without instant
sulting) only by a surgeon who possesses a large share
fertility of resource and dexterity in operating which
showed in so great a degree in this case. On the gener
tion, as to whether a case like the above ought to be
on Brasdor's plan, or as Mr. Syme treated it, it would
to affect to give a positive opinion; much would depe
the confidence of the surgeon in himself. If he felt
carry out to a successful conclusion so difficult an operat
would probably imitate Mr. Syme's practice; if not, he
try the distal ligature of the carotid. Should Brasdor's
tion fail to check the progress of the tumour, the old op
might be tried, and even a faint prospect of life might
to the patient from an attempt made to secure the arte
the aneurism had burst.

The above operation indicates so clearly the steps that
be taken in securing the carotid on account of a woun
no further description of that proceeding is necessary.

ANEURISMS IN THE UPPER PART OF THE NECK, THE AND THE CRANIUM.

Aneurisms above the root of the neck will be found
either the common carotid just at its bifurcation, or the
of the orbit or cranium. The diagnosis in either of
former situations can generally be established satisfa

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* *Observations in Clinical Surgery*, p. 154.

few things are so difficult as to distinguish from each other various diseases which may cause pressure on parts of the in, or disturbance of the cerebral functions.

The occurrence of dilatation at the upper end of the common rotid artery in a slight degree is natural; and this natural tation is comparatively often so far increased that an aneur-m results. It is an old observation, that the carotid is the ly form of surgical aneurism which is equally frequent in th sexes, if it be not even more common in women. The gnosis of aneurism situated in any part of the neck, above at portion of the carotid which lies in the immediate vicinity the subclavian, cannot present any especial difficulty if the is formed and the pulsation distinct.* The proximity of tumour to the air-passages and to the nerves which supply larynx may cause dyspnœa, hoarseness, or even loss of ech, nausea, and perhaps impairment of appetite. There ll also be giddiness, and trouble in the head; and perhaps in, numbness, or other nervous phenomena over the head d face.† These symptoms call for decisive and efficient rgical treatment.

Aneurisms situated within the orbit are usually supposed to of the 'anastomotic' variety; but the evidence on this point far from conclusive. Mr. Busk ‡ has shown that many, any rate, are of the ordinary traumatic variety; and Mr. unneley, in his papers on the subject, which give the result the most extensive experience in this particular which has llen to any individual, since no less than seven cases have en under his own care, goes so far as to question entirely the rrectness of the common opinion, founded on Mr. Travers's e; and believes that all the aneurisms have been of the linary spontaneous or traumatic kind, except those which re spread into the orbit from a nævus of the face.§ Whether

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A case of ruptured artery is mentioned on p. 421, in which much difficulty at first experienced in forming a diagnosis.

See the account of Sir A. Cooper's case, *Guy's Hospital Reports*, vol. i. 3.

Med.-Chir. Trans. vol. xxii. p. 133.

Haynes Walton (*Surg. Diseases of the Eye*, 2nd ed. 1861, p. 230) relates a e of congenital tumour protruding the eye, and causing slight pulsation and a arterial souffle not heard on the other side.' Crying greatly increased protrusion, and the vascularity of the conjunctiva, which was always con-erable. It was diagnosed by himself and colleagues to be aneurism by astomosis.' The carotid was tied with perfect success.

all the cases have been so or not, the general correctness
Nunneley's opinion is not to be impugned, that *most*
cases (and probably Travers's among them) were commor
isms.* Both the symptoms and the history prove thi
Nunneley's arguments are these: aneurism by anas
comes on gradually, generally in early life, as a resul
growth of a congenital nævus; aneurism of the orbit v
denly, often as the result of a blow, and almost al
advanced life:—aneurism by anastomosis occurs in the
taneous tissues; aneurism of the orbit generally in the
part of the cavity:—aneurism by anastomosis involve
neighbouring vessels, arteries and veins, in active
aneurism of the orbit is generally limited to a single
if the neighbouring vessels are dilated, they seem only
from obstruction:—ligature of the trunk of a vessel le
an undoubted aneurism by anastomosis is an extremel
cessful operation; in aneurism of the orbit, a very s
one:—finally, the cases dissected have turned out to be
aneurism.†

So far Mr. Nunneley argues, and to my mind very
against the view of the pathology of this disease which
the symptoms to aneurism within the orbit. A further
of much interest is raised by Mr. Nunneley's papers ‡
position of the disease. The prominence of the eye
pulsation of the orbit naturally led to the conclusion
tumour lay in that cavity; but Mr. Bowman's case, re
below, shows that all the symptoms of 'orbital aneurism
produced by disease situated in the cavernous sinus, an

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* This is important, since the success of Travers in tying the
been used, under the assumption that his case was aneurism by a
to enforce the recommendation of a similar operation in cases of a
anastomosis on the scalp—an operation by which several lives
probably been sacrificed.

† See Mr. Nunneley's account of the dissection of a case under his
proved fatal, in *Path. Soc. Trans.* vol. xi. p. 8. I may observe, that
of the ophthalmic artery and its branches are represented in the dra
accompanies Mr. Nunneley's description, as dilated, which brings the
what near to cirsoid aneurism. I do not understand how Mr. Nunnel
for this dilatation by saying it is the result of obstruction. Such
might act on the artery behind, but surely not in front of the aneurism
(*Operative Surgery of the Eye*, p. 168), in referring to the dissection
merely says that he found 'true aneurism of the ophthalmic artery of

‡ *Med.-Chir. Trans.* vol. xlii. pp. 183, 4: vol. xlviii. p. 15.

Mr. Nunneley's own cases, examined after death, nearly four a half years after ligature of the carotid, there was found ured circumscribed aneurism of the ophthalmic artery in sella Turcica (*Med.-Chir. Trans.* xlviii. 29), the vessels in orbit being of very small size. Mr. Nunneley believes that the great majority of cases of protrusion of the globe, the se is pressure on the venous channels behind the orbit; and view seems the most probable one. It seems that common culated aneurism of the ophthalmic artery (or possibly of end of the internal carotid) follows after an injury, and is companied by perceptible aneurismal pulsation and common urismal bruit; arterio-venous aneurism may also be thus duced, but will present probably a different kind of pulsation bruit;* but protrusion, bruit, and pulsation may all be duced more gradually by the numerous causes which may d to obstruction of, or pressure upon, the great vessels in cavernous sinus.

The diagnosis of anastomotic aneurism in Travers and Dal- aple's cases rested on the presence of soft compressible illing tumours in various parts of the eyelids, which pre- ted a more distinct pulsation when pressure was made on m. It is most probable that these were merely collections veins enlarged by pressure, and transmitting pulsation from aneurism lying beneath them.†

neurism may also affect either the internal carotid artery, its bony canal or in the cavernous sinus, or one of the eries of the brain. The symptoms of aneurism affecting the ernal carotid in the sinus are mainly of three kinds: (1) the ptoms of aneurism; (2) the symptoms of pressure on the or- l nerves; (3) those of disturbance of the cerebral circula- n.

1) In a well-marked case the symptoms of aneurism will ne on rapidly, very likely after a blow or other injury; there l be, perhaps, a sharp crack heard, followed by a sawing or ping noise. This sound will be perceived by the stethoscope plied to the head or neck, more plainly on the affected than

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* A case of arterio-venous aneurism in the cavernous sinus, under M. Nélaton's which was diagnosed as an aneurism of the ophthalmic artery, is shortly red to by Dr. Holmes, in the *Am. Journ. Med. Sc.* July 1864, p. 46. The is probably reported more at length in some of the French journals.

† See a paper by Mr. Hart, *Lancet,* March 15, 1862, on a case of arterio- us aneurism in the orbit cured by ligature of the common carotid artery.

[illegible] making pre[illegible] [illegible] of the disease. [illegible] in the sinus, [illegible] The first symptom [illegible] with external [illegible] pressure on the third nerve [illegible] supplied by the [illegible] nerve. [illegible] The side of the disease is usually not affected; [illegible] more or less [illegible] These symptoms of pressure on the [illegible] symptoms. [illegible] headache, giddiness, inability to sleep [illegible] There is no pressure on the brain [illegible] growth of the tumour is impeded by the dura mater. [illegible] possible that the aneurism might grow through this [illegible] and cause softening of the base of the brain: but I [illegible] met with such a case.

With such a combination of symptoms, then, the di[illegible] of aneurism may [illegible] be made; and the case [illegible] in the present state of our knowledge, be [illegible] such.

Such a case was the following, which occurred under the care of M[illegible] and [illegible] The patient was a woman, aged [illegible] [illegible] a blow five months before, after which she [illegible] of a [illegible] and beating noise in the head, which at the time [illegible] she likened to the puffing of a steam-engine, heard more distinctly [illegible] than the right ear, and accompanied by a continuous sound [illegible] emanating from a spot near the posterior superior angle of the [illegible] bone. She could not lie down in bed, and was troubled with [illegible] There was no bruit in the heart or great vessels, but a most distinct [illegible] neck and over the whole surface of the head, especially the left [illegible] pressure on the right carotid had no influence over the sound, but [illegible] carotid caused it to cease immediately. On auscultating the [illegible] fully, its pulsation could be separated from the bruit, which was [illegible] the left side. The left eye squinted a little, and she saw double. [illegible]

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* It would seem from Mr. N[illegible]'s cases that in some of these [illegible] the sinus, or even more internal, there may be pulsation and [illegible] I have seen such aneurisms, however, unaccompanied by any [illegible]

† *Assoc. Journal*, 1855, p. 1067.

‡ *Path. Soc. Trans.* [illegible]

§ Id. ibid.

¶ *Assoc. Journal*, [illegible]

side of the other. No tumour could be perceived externally. The left tid was tied on Dec. 11, 1851; the bruit ceased; a gentle continuous mur followed (ascribed by Mr. Coe to the flow of blood through the tumour the anastomosing branches); this ceased in about five hours, and all the ptoms subsided. The woman was cured, and, as I was informed by Mr. remained well about ten years afterwards.

n deciding, however, on the treatment of orbital aneurism surgeon should not be in a hurry to recommend any opera- measures, unless clearly indicated by the symptoms of the e before him. Mr. Erichsen* refers to two cases in which symptoms of orbital aneurism spontaneously disappeared, a case which occurred under Mr. Bowman's care,† must be t in mind, as showing that the diagnosis cannot be regarded ertain.

that case many of the above symptoms were present—severe pain in the l, after an accident, aggravated by stooping; disturbed sleep; a beating e in the head, compared to a steam-engine; a loud bruit, synchronous with pulse; troubled vision: protrusion of the globe of the eye, and pulsation he orbit strong enough visibly to lift the fingers. The carotid artery was , and the bruit ceased, but recurred, though not so loud, eight days after- ds. The patient died of secondary hæmorrhage, when it was found that arteries were quite healthy; and the only diseased appearance was in the thalmic vein, cavernous, circular, transverse, and superior petrosal sinuses, ich were filled with coagula. The pressure on the carotid artery in the us must have produced the bruit, the obstruction to the return of blood by veins of the orbit, the protrusion of the eyeball, and the congestion of the ts around it; while the pulsation perceptible in the orbit is attributed by . Hulke, to whom we are indebted for the report of the case, to the same use. 'Each diastole of the ophthalmic artery,' he says, 'must have been ended by a general momentary increase of the whole quantity of blood in orbit, because its exit through the ophthalmic vein was cut off, and the isting bony walls of the orbit could permit a distension in front only.'

The symptoms of aneurism of one of the small arteries at e base or in the substance of the brain, are as yet quite scure. Physicians and physiologists are busily endeavouring, experiment and the study of cases, to decide how, from the nptoms of limited pressure or other limited lesion, to deter- ne the precise part of the brain affected. Even if this great ficulty were got over, how are we to decide whether such

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Science and Art of Surgery, ii. 78. A case is related by Dr. Holmes, *Am. rn. Med. Sc.* July 1864, p. 44, in which the patient recovered under the use rgot of rye and tincture of veratrum. 'Whether the patient's recovery,' s Dr. Holmes, 'is due to the remedies prescribed, or independent of them, I unable to say.'

Streatfield's *Ophthalmic Reports*, April 1859.

limited injury depends on pressure by an aneurism, o
tumour of a different kind, say a scrofulous tubercle?*
rapidity of the onset of the symptoms, and the variat
their severity, occasioned by different states of the circu
seem the only peculiarities which point to aneurism, an
are excessively doubtful and delusive. We have, ind
means at present of diagnosing cerebral aneurism, u
bruit could be found; and in looking over a number
I do not find any mention of this symptom having been
for. In Dr. Ogle's case, however, the patient was hers
scious of 'a sawing noise' in the head. It seems, th
that in similar cases the head should be carefully ausc
though it is very likely that the small size of the aneur
of the vessel on which it is seated, and the mass of
conducting parts that lie over it, would prevent bru
being heard.

Treatment of these aneurisms.—Aneurisms situated in
rotid triangle of the neck must be treated on ordinary pr
digital pressure on the trunk of the vessel being used
where the symptoms are not very urgent, combined, p
with moderate pressure over the tumour (*vide* p. 493); in
cases, or on the failure of these measures, the common
artery must be tied. Besides the ordinary medical and
means, and excluding a very few cases in which the
might be tempted to try the effect of galvano-punctur
are only two methods of treatment available for a
within the cranium or orbit, *i.e.* pressure on, or ligature
carotid artery. The use of digital pressure has been su
in supposed aneurism of the orbit, under the care of Gio
Vanzetti (p. 498); and there can be no reason why it
not succeed in such a case as Mr. Coe's. It need n
much annoyance to the patient, and can be carried
long as the disease is either receding, or even not adv
When its failure is certain, the common carotid artery
be secured.† It would at first sight appear better, as the

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* See, in *Med.-Chir. Trans.* vol. xlii. p. 403, a paper by Dr. Ogle,
he carefully endeavours to point out how, from the symptoms present
case there related, he might have diagnosed lesion limited to the pon
Even had he done so, however, he would have referred the lesion to
by a scrofulous tumour, while it was in reality an aneurism of the
cerebellar artery.

† In Mr. Hart's paper he attributes to the previous use of digital

ated upon the internal carotid, to secure that vessel; but oes not seem that any advantage is obtained by leaving stream of blood in the external carotid unobstructed. In tal aneurism, the free anastomosis might reproduce the se; in aneurism at the base of the brain, the danger of ning of the brain is as great after ligature of the internal of the common carotid; while no harm ever comes from ping the circulation through the branches of the external tid. So that, as the ligature of the common carotid artery a easier and safer proceeding, it is rightly performed. Dr. ton * gives a list of thirty cases in which the carotid has tied for 'orbital aneurism;' twenty-two of which succeeded pletely and three incompletely in arresting the symptoms; were unsuccessful, but the patient survived; three died. ection was used successfully in two cases, and digital pres- e in two.

The ligature of the common carotid in an ordinary case of urism, where the patient is not very stout, the aneurism not ated near the root of the neck, but towards the angle of the ,† and the parts healthy, is generally an easy operation. artery can be felt, in any person not extremely stout, pul- ting on the anterior edge of the sterno-mastoid muscle, at e level of the cricoid cartilage, where it first becomes super- cial, after having been crossed by the omohyoid muscle—the pex of the carotid triangle. This is accordingly the place of lection for the ligature. The operation is thus performed: the sterno-mastoid muscle is perceptible, an incision about wo and a half inches in length (in a moderately stout adult) is be made along its anterior edge, the centre corresponding to e level of the cricoid cartilage; and after the cervical fascia as been divided, which may be done freely, as no important arts are endangered, the edge of the sterno-mastoid ought to

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nd consequent dilatation of the collateral arteries, the entire immunity from all ymptoms which his patient displayed after ligature of the carotid artery; an mmunity which was certainly remarkable.

* *Am. Journ. Med. Sc.* April 1865, p. 318.

† This observation of course applies still more forcibly to the cases in which he disease is situated in the orbit, and therefore quite away from the parts perated on; but in a case where Brasdor's method was applied for a tumour t the root of the neck, and in a case of Hunterian ligature, where the tumour as lower down than usual, I remember seeing considerable difficulty ex- erienced by the operators from the circumstance that the artery had been isplaced backwards by the pressure of the tumour.

be exposed. This having been drawn a little
finger should be passed into the wound, to feel for
when the artery will be felt lying between the mu
air-tube. The operator must now carefully separ
lar tissue from the sheath which covers the art
deavour to raise the descending branch of the
which generally lies upon the sheath. This nerv
posed, is to be held aside with a blunt hook, wh
opening is made in the sheath of the artery; an
having been cleaned by the usual manipulations, th
to be passed around it from without inwards, great
taken to keep the point of the aneurism-needle
to the artery, so as to avoid wounding or tying th
gastric nerve. The operator must remember that t
dens noni nerve sometimes lies within, instead of
sheath of the vessels; so that, when it has not been
after a sufficient search, the artery may be tied with
it; but in this case even more than common care
bestowed in examining the vessel as it lies upon the
needle, in order to make sure that this nerve has
included. In the course of the dissection some blee
occur from the sterno-mastoid artery, which is usuall
scending branch of the superior thyroid, and may pro
ing to the operator unless the vessel be tied.

When the aneurism is situated lower in the neck, t
tion becomes more difficult, since it is necessary to cu
a considerable mass of muscle. The artery is here
under cover of the sterno-mastoid with the sterno-h
sterno-thyroid muscles. An incision must be made
course of the artery, viz. the line joining the sterno-
articulation with the point midway between the an
jaw and the mastoid process, and this incision may
by another running outwards. The inner, or sterna
of the sterno-mastoid is to be cut across, and this bei
outwards with a broad retractor, it will be generally p
draw the two other muscles inwards, otherwise they
divided. The sheath of the vessels will now be exp
there will in all probability be several large veins lyin
which descend from the thyroid body, and on the le
the neck the internal jugular itself inclines considera
front of the artery towards the thorax. The woun
very deep, and the vessel is probably rendered relativ

he projection of the tumour. Still, by keeping the course he vessel steadily in view, and by feeling for the trachea rnally and the transverse processes of the vertebræ behind, artery must be reached. Great care, however, is necessary pening the sheath and cleaning the artery, since the vessel lf can hardly be brought fairly in view. The proximity of stream of blood in the innominate artery on the right side great, but not a fatal, objection to this operation. Porter* l the right carotid successfully within half an inch of the rcation of the innominate.

he operation of tying the common carotid artery used to be ked upon as one of the most successful in surgery; and haps, if we regard the important parts whose circulation is rfered with, that opinion may seem relatively justified; but olutely the mortality is now known to be very considerable.

n the paper on the subject by Dr. Norris above referred to, the result of 149 s in which the carotid was tied, has been tabulated. Of these, 54 died, or more n one-third; an amount of mortality much exceeding that of any of the comer operations of surgery. Dr. Norris's paper, however, includes all classes of s, tabulated as:—I. Operations for aneurisms (Hunterian); II. For wounds; In or previous to extirpation of tumours; IV. For cerebral affections; V. For tile tumours of the orbit, scalp, &c.; VI. On Brasdor's method for aneurisms. may consider separately the cases in which the artery is tied for the cure disease, by excluding classes II. and III.; and then Dr. Norris's table ecting one case, in which it is doubtful whether the artery was really tied) s us exactly 100 cases, with a mortality of 33. It seems, therefore, fair to that the ordinary ligature of the common carotid for diseases involves a which may be represented on an average by a mortality of one-third. sibly, where the disease is remote, the chance of recovery is greater. In Morton's paper, above referred to, out of thirty cases where the carotid was for aneurism in the orbit, only three died.

r. Pilz's statistics † give exactly 600 cases—thus divided:—

	Cases.	Cured.	Died.	Unaccounted for.
For bleeding	228	94	128	6
For aneurism	87	55	31	1
For tumours	142	87	49	6
For extirpations	71	38	25	8
For affections of nervous system . .	34	33	1	—
For aneurism, on Brasdor's method . .	38	12	25	1
	600	319	259	22

Deaths . . . . 43·16 per cent.

r. Pilz deducts from the mortality 29 cases where death was due to other ses, *e.g.* where the carotid has been tied for hæmorrhage really due to wound of the vertebral artery, and which proved fatal. The general i the mortality due to the operation is the same as from Norris' extraordinary success of the operation when performed for 'affecti vous system' (*i.e.* for epilepsy, headache, and neuralgia), shows th other ligatures of arteries, it is not so much the intrinsic danger o which leads to its great mortality, as its performance upon p seriously diseased or injured—though this does not, of course, ex formance of the operation in such cases.

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* Sup. cit.

† Langenbeck's *Archiv.* vol. ix. 1868, p. 394.

M. Le Fort's paper on the therapeutical value of the ligature o carotid artery, in the *Gaz. hebd.* 1868, Nos. 28, 30, 35, does not cont number of cases as those of Dr. Pilz, his total being 435, nor is it ac the references. It is very possible, however, that it may be free fr which (as M. Le Fort hints) somewhat detract from the value of author's elaborate paper. M. Le Fort's essay is well worthy of perusa not forbear to quote its conclusion, as being, I think, justified by ou of this operation: 'The ligature of the external carotid ought to be su that of the common carotid whenever it is possible; and if the latter a rare one, it ought to be still rarer; not only from its danger, but als is inefficacious in many more instances than would be thought, if jud by some fortunate cases which are known and quoted by all the worl

Both carotids have been tied in a great number of cases. *In one* the double ligature was simultaneous; the patient died in twenty-fou coma. The simultaneous ligature should never be performed unless t should be afforded of thus treating a case of wound, which, however, is ve bable. But there are many cases of successful ligature of both carotids, interval of time between the two operations. Tables of these cases will in Dr. Pilz's work above referred to (p. 415), and in Mr. Erichsen's p. 67). The general result seems to be, that (excluding Mott's fatal case taneous ligature) there have been 26 or 28 cases, of which at least 18 (pos recovered. Some of the patients who recovered had severe cerebral sy and one lost an eye from disorganising inflammation; but the above li clearly the possibility and even probability of recovery from so formid operative procedure. But the propriety of undertaking such treatme well be questioned. In many of the cases the operations were performed cure of epilepsy—a proceeding which I believe nobody would now coun Nor in aneurism by anastomosis can I believe that there is enough pro cure to justify so dangerous a measure. A few of the operations were d hæmorrhage—and of course any measure which is necessary to check rhage is justifiable—but we can hardly believe that such cases will ofte On the whole I think ligature of both carotids can hardly ever be a and very rarely justifiable.

The chief causes of death after ligature of any large a excluding those affections which depend on previous diseas the complications which follow on any grave surgical oper are secondary hæmorrhage and gangrene. The former is paratively rare after ligature of the carotid, in consequ

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[*] V. Mott, *Amer. Med. Journal,* July 1847; *Prov. Med. and Surg.* 1848, p. 137.

long course without branches. Still it is not perhaps so un- mmon as is generally supposed, since among the fifty-four l cases in Dr. Norris's table, hæmorrhage is noted as the e of death in fifteen of them, and it may have been present symptom in many of those which recovered.

angrene shows itself principally in the form of softening of brain. The external parts of the head and neck are never, it seems, affected with gangrene; a fact which is readily ounted for by the free anastomoses and liberal supply of the els of the face and neck. The anastomoses in the brain are sed even more abundant; but then the brain appears to be re in want of a constant and equable supply, and to tolerate lly the withdrawal for even a short space of so large a antity of blood as is brought to it by this great artery. Twelve the fifty-four cases in Dr. Norris's table seem to have proved al from some symptoms referable to the brain, which, how- er, are very variously stated; 'convulsions,' 'apoplexy,' and nflammation' of the brain, being the more common headings. may be allowed us to doubt, in the absence of more exact formation, whether this 'inflammation' was not, in most cases any rate, atrophic softening.*

Either the external or internal carotid may be tied for a wound f the vessel itself in the carotid triangle. The operation does ot essentially differ from that on the common carotid. An ncision made in the same line but higher up will lead down irectly upon the internal carotid. But the circumstances which would justify ligature of either of the secondary carotid rteries, except for wound, must be very rare. In aneurism affecting the internal carotid in the cranium, I have already stated he reasons which would lead me to prefer the ligature of the ommon carotid. I have not met with any account of cases of rue aneurism of the branches of the external carotid, except raumatic aneurisms of the temporal artery, which are usually nder the control of direct and indirect pressure, otherwise the emporal artery itself may be easily tied either by the Hunterian r the old method. But cirsoid or anastomotic aneurisms of the ranches of the external carotid are not so uncommon, and, upon he failure of other methods, it might be thought advisable to

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* See the observations on this head in Dr. Pilz's paper above referred to, 408 et seq.

on the external carotid artery. If
to secure the arteries on both sides a
done successfully by M. Maisonneu
of arteries derived from the commo
possible situations, the common ca
been tied, and with frequent succes
down the vehement censure of Mr.
the internal carotid from the fauce
he proposed† to secure the two e
carotid after having divided and
lower jaw, has not yet been demon
the living body, and it seems hardl
operation which will probably neve

We may, however, allow that ev
to secure the bleeding artery itself i
where that operation is plainly im
to resort to so uncertain a measure

In order to find the external
written a special memoir on the
directions. Make an incision dow
to the angle of the jaw to near the
mastoid, from one-third to half-an-
of the thyroid cartilage: dissect aw
the venous branches, connected
lingual veins, which lie over the ar
be torn away or lifted, for fear of te
adhere closely, but freely incised, a
if necessary. Then look for the hyp
the artery perpendicularly, and w
vessel lying immediately beneath.
an-inch of the trunk available for
ligature, between the origin of the
generally close to the bifurcation, a
and occipital above. The identity o
its relation to the hypoglossal nerve
(the superior thyroid) when it happe
fact that pressure on the exposed v

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* *Commentaries*, p. 256.

† The usual practice of securing the comn
essay on INJURIES OF THE VESSELS, vol. i. p.

‡ *Mém. de la Soc. de chir. de Paris*, tome

mporal. In twenty-three of the cases mentioned in M. n's paper where this vessel was tied, none died from the tion, and none had secondary hæmorrhage. In four of both external carotid arteries were tied, so that the number tients was only nineteen. The twenty-fourth case quoted L Guyon, was one in M. Maisonneuve's practice, where dary hæmorrhage took place after the separation of the ure: the common and internal carotid were tied, and the pathetic nerve was injured. The patient died.

ny of the branches of the external carotid which arise in carotid triangle may require to be tied on account of a nd; but no special directions appear necessary. The diag- s of the particular vessel injured would be impossible till parts had been exposed, when the bleeding would be the sure guide to the mouth of the artery. But the lingual ry may require ligature on account of disease or injury. The ation has now been frequently performed, either to check growth of cancerous tumours or to arrest hæmorrhage from tumours, or even from a wound. In either case it might be ssary to secure the artery on both sides.*

e operation is thus performed: The patient being in the nbent position, with the head drawn over to the sound side, a small pillow under the neck, an incision is made obliquely wards and backwards, about two and a half inches in th, its centre being opposite the end of the great cornu of yoid bone. The superficial parts being divided, the point e mentioned should be kept in view, and the lingual nerve sed. The artery runs deeper than the nerve to gain the surface of the hyoglossus muscle, and must be carefully ched for in the cellular tissue. This operation is more diffi- than the description would seem to imply. The reason is, as the parts are unsupported except by the loose and soft of the pharynx, the vessel is constantly retreating from the ator, who must be careful in conducting his dissection, for of wounding the pharynx. As the vessel is tortuous, it is ssary to keep close upon the end of the great cornu of the id bone—the only sure guide to it. In the dissection, a e vein, the internal jugular or one of its branches, may be osed.

See Moore, *Med-Chir. Trans.* vol. xlv. p. 56. The most complete memoir e subject of ligature of the arteries of the tongue with which I am ac- ted is by M. Demarquay, *Gaz. méd. de Paris*, 1867, p. 634.

The French method, which M. Demarquay seems to h adopted, is to make an incision more or less horizontal throu the fibres of the hyoglossus muscle at the apex of the digast triangle, below the level of the ninth nerve, and parallel to th hyoid bone. This is believed to be more certain than the oth method, since the artery sometimes comes off from the caroti along with the facial, and in such cases passes downwards t gain the cover of the hyoglossus. Mr. Heath informs me th he tied the lingual artery in this manner for hæmorrhage i cancer of the tongue on January 1, 1869, and found no difficulty though the operation was performed at night. On the divisio of the muscle, the artery at once presented itself.

In the former edition of this work, the ligature of the smalle arteries of the neck was passed over without special mention, nor indeed is the subject one of any practical importance; bu as the superior and inferior thyroid arteries have been tied in bronchocele, though the operation is not one which can be re- commended, it may be as well to describe the method by which they may be secured.* For the superior thyroid an incision is to be made two inches long, parallel to the inner margin of the sterno-mastoid, its centre corresponding to the great cornu of the thyroid cartilage. This brings into view the omohyoid muscle and the sheath enclosing the jugular vein, and common carotid, the fibrous lamellæ which cover the artery having been tor apart with a director, the superior thyroid may be found running downwards between the vessels and the thyroid gland; or i the facial is the artery sought for, it can be found by the sam incision, the search being conducted upwards towards the ja where the artery is found between the great vessels and th submaxillary gland.

The inferior thyroid is to be sought by an incision similar t that for the carotid in the lower part of the neck. It is usual concealed by the upper part of the omohyoid muscle. Th muscle must therefore be depressed or divided, and the arte sought for between the trachea or œsophagus and the trunk o the carotid. The recurrent nerve and the descendens noni wi be endangered in this operation.

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* See Mott's *Velpeau*, vol. ii. p. 227.

EGIONAL SURGERY OF ANEURISMS IN THE ABDOMEN AND LOWER EXTREMITY.

THE FOOT AND LEG.

in the upper extremity, so still more in the lower, aneurism dly ever affects the arteries below the great hinge-joint, ept as the result of accident. Spontaneous aneurism, it is e, is not unknown in the leg; but it is extremely rare. The seum of St. George's Hospital contains a specimen of aneur- of the posterior tibial artery cured by ligature of the oral; and other scattered examples of these aneurisms may found in pathological collections. These aneurisms, like se in the fore-arm, will hardly ever be found originating ntaneously except in subjects affected with extensive disease the heart and arteries; and appropriate position, bandaging, d digital pressure on the first accessible artery above the mour, will be the appropriate means of cure for these, as for ose. If this treatment should fail, it will be for the surgeon consider whether his patient has sufficient vital power to rvive the ligature of the femoral artery, and whether the ease is grave enough to justify the risks by which that eration must be attended.

Pressure and proper position will, in all probability, stop eding from any vessel in the foot; but it is possible that a umatic aneurism in the foot or near the ankle may necessitate ligature of one or other of the tibial arteries; these vessels, wever, are much more often tied on account of wound.

The *ligature of the anterior tibial* may be thus performed. If vessel requires to be tied above the middle of the leg, it will found very deeply placed on the interosseous membrane, tween the thick muscular bellies of the tibialis anticus on the e side, and on the other of the external longus digitorum ove, and extensor proprius pollicis below, tightly bound down the fascia of the leg. In order to reach it on the living ject with any tolerable facility and in any tolerable time, the ermuscular space must be hit, and the vessels exposed without groping about among the muscles. This can be easily done the dead subject, but on the living the operation must be one

original wound, and the muscles drawn fore
retractors, the ankle being flexed in order t
at the bottom of the deep interval, the nerv
and below it the vessels will be found inclin
Even in the dead subject there is often con
getting a ligature round the anterior tib
operator wishes not to include the veins, w
living body would be almost a matter of in
difficulty would be much increased in practic
operation would probably be undertaken on
and that the neighbouring parts would
extravasated blood, the muscles perhaps
cavity in which the vessel lies so deep t
which alone the artery could be recognised,
obscure and hide the bleeding orifice. H
great pains should be taken to endeavour t
ing by graduated compresses, or by digital p
before resorting to an operation which ma
so, may cost the patient his limb.†

In the lower part of the leg, where the
in their tendons, and where the vessels a
tibia, there will be much less difficulty in fin
the line of incision is the same, and the s
anticus) serves as a guide, the artery lying

The remarks above made, as to the propri
if possible, to avoid operating on small arte
as those of the upper part of the leg, ap
tibial, and still more forcibly to the peron

no special instructions are needed for this operation, which isted merely of making a very long incision in the middle of the calf (seven inches in length, with its centre at the nd), dissecting down towards the fibula, turning out the a, and looking for the bleeding point; in doing which it was ssary to cross the incision by one running towards the la, so as to turn down two little flaps. The bleeding point ing been seen, a sharp hook was struck into the tissues ar it, and the whole was tied up in two ligatures above and w the part whence the bleeding proceeded. As the patient vered, it was, of course, impossible to affirm that the oneal was really the artery which had been tied.

igature of the posterior tibial in the upper part of its course, re it lies under the deep fascia which separates the mass of scles forming the superficial layer of the calf from those ich form the deeper layer, can be effected in one of two ways. e first of these consists in making an incision of suitable gth (say six inches) along the posterior edge of the tibia, l having divided the fascia, pulling the gastrocnemius away, ting the soleus off the tibia to the extent to which it is exed, and thus coming down upon the deep fascia, which covers artery, and which is to be divided with the usual precautions, order to search for the vessel lying below it. This way of king the incision, which is the old method of reaching the sel, is condemned by Mr. Guthrie as 'difficult, tedious, bloody, d dangerous;' and he proposes to substitute for it a vertical ision along the middle line of the calf, over the position of vessel, through the gastrocnemius and soleus muscles. Mr. thrie himself never had the opportunity of carrying out this gestion; but it was put in practice by Mr. Arnott in a case re he tied the artery for a wound.*

n that case, indeed, the position and direction of the exnal wound would have indicated some such course; but Arnott has put on record his preference for Mr. Guthrie's thod, and advises that it should be followed if it should ever ome necessary to tie the posterior tibial on account of aneursituated low in the leg; a necessity which does not seem erto to have occurred. Mr. Arnott, however, remarks about operation what is probably even more applicable to the old cedure. 'It is not one which should be undertaken inconsiderately. It requires good light, and intelligent assistan The case which has been described occurred in the daytim and from what was then experienced, I am disposed to thi that it would not have been successfully performed by artific light, or at least with greatly increased difficulty.'* T difficulties which Mr. Arnott experienced were dependent, h says, on the depth of the wound, the pain and cramp on pressure of the divided muscles, and the venous hæmorrhage from concomitant wound of the venæ comites. Of these difficulties, Mr. Arnott rates the first as the least, and the last the greatest. The second would, of course, in the present day be avoided entirely by anæsthesia; but the third must always be anticipated in operations for wound of the artery, since the venæ comites are closely connected to it. Pressure in the angle of the wound from which the bleeding comes must be maintained as much as possible during the operation by the finger of an assistant. The trunk of the femoral or popliteal is of course secured by a tourniquet. An incision is to be made six or seven inches in length, down the middle of the calf of the leg, including the skin-wound in its centre. The gastrocnemius and soleus muscles are to be freely divided in the course of the wound, and held aside by broad retractors. Now the operator should search carefully for the deep or intermuscular fascia, immediately beneath which the posterior tibial vessels will be found. The situation from which the bleeding comes will point out whether it is the tibial or peroneal. If the latter be the artery wounded, most likely a good part of the flexor longus pollicis must be scraped off the fibula in order to find it, or (as Mr. Guthrie seems to have done) all the tissues around the bleeding point must be included in the ligature. If it be the tibial, it may be exposed with rather less difficulty; still, it is a most difficult operation, as will be evident to any reader of Mr. Arnott's account, although in that case the wound was only recently inflicted, and Mr. Arnott had able assistance at hand. In cases where much blood has been infiltrated into the leg, obscuring all the neighbouring parts, or where the surgeon is not very much versed in operations, or has to trust mainly to his own hands, it would perhaps be the better course to amputate; but I may be excused for repeating that properly-applied and carefully-graduated compresses, or the prolonged pressure of a finger in the wound, enlarged if necessary, would often render

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* *Med.-Chir. Trans.* vol. xxix.

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[*] Op. cit. p. 51.

operation unnecessary. In a recent traumatic aneur- robably one of the various methods of applying direct or ct pressure would succeed. If any operation became sary, most surgeons would prefer to tie the femoral artery. , perhaps (but they would be very few), might treat the like a wounded vessel, by the old operation.

the posterior tibial artery requires a ligature in the lower of the leg, the operation is more simple, on account of the depth at which it lies. An incision is to be made, about e inches in length, parallel to the inner border of the tendo hillis, and the vessel is to be sought on the outer side of the large tendons which pass behind the inner malleolus, that the flexor longus digitorum being the nearest to the vessels. hind the ankle the tendon of the flexor longus pollicis is on e opposite (external) side of the artery, but in ordinary cases ill not come into view.

The popliteal artery has also been tied on account of subcutaneous rupture, nsuccessfully as far as the result of the case went, since gangrene set in on the hird day, followed by amputation and death; but no difficulty was experienced n the operation,* which is thus described by the operator: † 'Mr. Poland made an incision from seven to eight inches in length along the course of the popliteal artery, and cleared out much coagulum, and without difficulty found the ends of the ruptured artery lying an inch and a half apart; the upper end seemed to be plugged by coagulum, and was secured by ligature; the lower end seemed to be patent, and was similarly ligatured. The popliteal vein was distinctly seen, and appeared to be uninjured.' ‡

In the *Lancet* for August 28, 1869, will be found an interesting case in which Mr. J. D. Hill tied this artery to check the growth of an encephaloid cancer of the leg. The patient survived nearly four months, but died of hæmorrhage from the diseased tissue. The operation seems to have been unattended with difficulty, and being performed on parts free from extravasation or swelling, was accomplished with a shorter incision than in Mr. Poland's case. Mr. Hill gives a diagram of the anastomotic circulation, which is described as being carried on 'by the anastomotica and superior internal articular arteries communicating directly with the anterior tibial recurrent, and by the descending branch of the external circumflex artery receiving the superior external articular, and inosculating with a branch of the anterior tibial recurrent. The posterior tibial artery was supplied by the inosculation of some muscular twigs arising from either [tibial] artery, and passing across just opposite the anterior tibial recurrent. The posterior tibial was small and contracted.'

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* In the only two other cases, however, reported in Mr. Poland's paper, where the artery was sought for, the operation proved impracticable. The femoral artery has also been tied on account of this injury in two cases, but gangrene and death followed in both. Mr. Poland speaks in terms of merited reprobation of the practice.

† *Guy's Hospital Reports*, 3rd series, vol. vi.

‡ On examining the parts after the amputation, Mr. Poland found that the knee-joint had been laid open by an extensive laceration of the posterior ligament, a complication which would probably have precluded recovery even had gangrene been averted; and as this same complication was present in three cases successively admitted into Guy's Hospital (the first three in Mr. Poland's collection), the point ought to be carefully investigated during the operation of tying the artery for rupture, by passing the finger into the deep parts of the wound, when if either condyle of the femur can be felt bare, amputation should be performed.

POPLITEAL ANEURISM.

Although popliteal aneurism is so frequently curable without operation, yet operations for its cure constitute the great majority of those performed for aneurism.[*] The popliteal artery is so frequently diseased, because it is liable to strains both in flexion and (though to a much less degree) in forced extension of the joint;[†] also because it is the end of a large tube, curved alternately forwards and backwards, which divides abruptly into much smaller branches, and is supported only by fat, while its branches plunge at once among muscles.

The symptoms of popliteal aneurism are usually quite characteristic.[‡] The attention of the patient is called to the part by the tumour or by pain and stiffness of the limb, or by the pulsation—very commonly the latter; and on examining the part the surgeon is left in no doubt of the nature of the complaint. The aneurismal bruit is usually distinct, though cases are sometimes met with in which it is absent. The feeling of the pulsation differs somewhat according as the aneurism is growing towards or away from the joint; that is, according as it is situated on the front or the back of the vessel. The most usual position appears to be at the back of the artery towards the skin of the ham; and then the pulsation is of the usual equable heaving and expansive character. But when the aneurism is growing towards the joint, and the artery therefore is raised upon its posterior surface towards the skin, the pulsation feels much more thrilling, and a distinct line of separate pulsation often marks the course of the vessel. The position of the aneurism also materially influences the probability of cations involving the joint. A large tumour rapidly ig on to the posterior ligament of the knee, must cause erable irritation in the joint; and synovial inflammation his cause is a frequent accompaniment of popliteal aneur- Still further, the resistance to the growth of the sac d by such firm structures as the bones and ligaments joint soon leads to ulceration, so that such aneurisms ible to burst into the knee-joint; the symptoms and in- ns of which event have been pointed out on pp. 427, 483.

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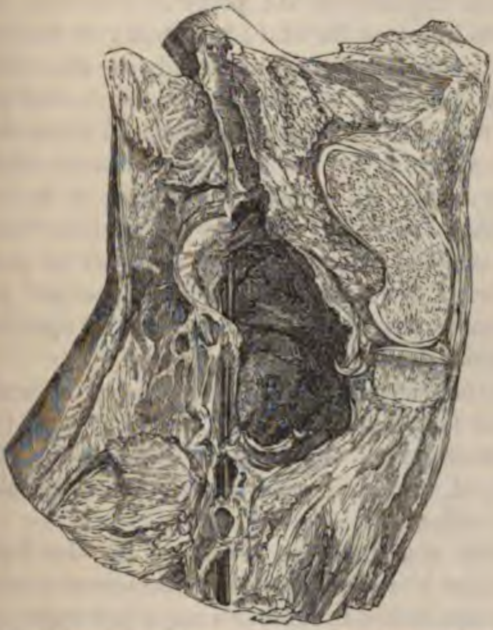
[*] In the *Med. Times and Gaz.* (supr. cit.) seventy-five cases of ligature of large arteries are reported, of which fifty-one were of the femoral, in almost all cases for popliteal aneurism.

[†] Very few sedentary persons or females suffer from this disease. In Norris's table, out of 155 patients, five only were females.

[‡] Further observations on the diagnosis of bursal and other tumours in the ham from aneurism will be found in the essay on DIAGNOSIS AND REGIONAL SURGERY.

FIG. 167.



of a popliteal aneurism. The section runs perpendicularly through the artery ve; a probe marks the course of the lower part of the vessel. (Museum Royal lege of Surgeons, No. 1703.)

part of the artery affected varies; but the aneurism y presents in the middle of the popliteal space, and bulges low either hamstring. On dissection, the opening in the is most commonly found near its lower end.

ordinary relations of popliteal aneurism are well shown reparation by John Hunter in the Museum of the Royal e of Surgeons, of which the annexed figure is a copy.

tment.—The treatment of popliteal aneurism is usually sful, since such tumours partake of the nature of the forms of traumatic aneurism, and often occur in comurgeons for certain cases of aneurism in the thigh, and eliminary to some operations.

great advantage of Scarpa's operation, for securing the just as it is being crossed by the sartorius muscle, is e vessel is exposed at a point where it is superficial, and re easily found; while at the same time it is far from gin of any large branch. The operation in a natural on of parts and a patient not very stout is usually easy. outline of the sartorius muscle is plainly perceptible, ll perhaps be the easiest and surest guide. Otherwise a awn from the centre of the fold of the groin to touch the order of the patella when the foot is a little abducted, ark the course of the vessel. An incision three or four long having been made in this direction through the id subcutaneous tissue (in which it will be well to avoid ge branch of the saphena vein), the fascia lata will be ised, and should be divided on a director to the whole of the wound. This should expose the inner edge of torius, which must otherwise be sought for by dividing llular tissue carefully without going deeper into the ; and when the muscle is recognised, but not before, the of the vessel is to be sought. It is generally found at y drawing the muscle slightly outwards, and the pulsa-felt. A nerve is usually seen in front of the artery, and e excluded from the ligature. This may be either the l saphenous nerve or a smaller branch of the anterior * A small opening is to be made in the sheath, and ed to such an extent that the artery is fairly exposed; en the vessel should be so far cleaned as to allow the m-needle to be passed round it without material re-e. The great danger at this step of the operation is e vein should be injured, or should be included in the e. To avoid the first mistake, great gentleness is re-in cleaning the artery and in passing the needle round ile the second seems impossible if the vessel have been

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mall nerve is often seen on the front of the sheath, but the saphenous elf does not come into connection with the artery so high up as the t of operation. Where it is in relation with the sheath, it lies rather to the position of the artery, firmly bound down by a separate layer of hich appears to form a portion of the sheath. Hence, if the sheath is nly by a small puncture over the inner part of the vessel, the nerve come into sight.

once fairly and cleanly exposed. The position of the vein m be accurately remembered; it lies almost directly behind artery, inclining perhaps a little to its inner side. Hence are usually recommended to pass the needle from within wards. This being so, if the front of the artery have been cleanly denuded, and the point of the needle have been fa applied to it, it seems impossible that the needle can be thr to the deeper side of the vein, without an amount of viole which is never used on the living subject; nor can the nee even perforate the septum which separates the artery from t vein, so as to wound the latter, without more force than justifiable. If the occurrence of venous hæmorrhage show that the vein has been punctured,* the bleeding ought to be commanded by pressure, which is not difficult, and the operator must make up his mind either to abandon the operation for the time, and seek the vessel at a higher part of its course after a few days, or (which is perhaps the preferable course) to enlarge the incision upwards, and tie the artery with more care, about an inch above the spot originally selected. The ligature should on no account be tightened in the part where the needle has first wounded the vein, since in this way the thread would be left in the vein to act as a seton, and phlebitis could hardly fail to ensue, and would most likely prove fatal. If the needle have glided round the vessel without any such accident, the next step is to determine that the tissue embraced by it is really the artery, and nothing else. This is easily ascertained by pressing lightly on the tissues raised by the needle, and examining the part with the finger. The pulsation of the vessel will be felt; on making pressure, the beating of the aneurism will cease at once; while, if any doubt exists on that point, the absence of congestion shows that the vein is not included. Nothing then remains to be done except to tie the ligature firmly, and close the external wound with strapping or sutures.

In a case of ligature of the femoral artery which is to do well, the warmth of the foot, which is maintained by wrapping the limb in cotton wool, remains slightly above that of its fellow for a few days; the patient lying quiet does not notice ıess and partial paralysis which would no doubt hemselves if he tried to move about; sensation is ıe ligature may be expected to fall any day after the *

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* Slight arterial hæmorrhage is sometimes observed as the needle is passed round the artery, and stops when the ligature is tightened. It proceeds, in all probability, from the wound of a minute branch near its origin from the vessel.

ef danger after the operation is from gangrene. In 's statistics,† of 204 operations (for all causes), fifty ; of these fifty, the cause of death is not stated in of the remaining forty-six, twenty-three, exactly ied from gangrene, while hæmorrhage proved fatal ses only; five of the remaining deaths are attributed s, one to sloughing of the sac, and the rest to accises common to all operations—tetanus, fever, hectic, c.

hage, however, occurred in numerous cases in which prove fatal, having been arrested by pressure. In pply pressure effectually to the femoral artery when hæmorrhage takes place, a graduated compress should ery carefully on the wound by means of a pressethe bleeding point should be commanded by the a relay of well-instructed assistants. Should these to arrest the bleeding, the external iliac artery must the limb amputated, unless the surgeon choose to he wound, and tie up again the bleeding portion of . Mr. Erichsen declares himself in favour of the e of treatment. The first is the course most usually in our surgical works; but it has always (according ichsen) been followed by gangrene. The ligature of ıg portion of the artery is an operation which must difficult, and which may prove impracticable; yet it ıttempted when the parts are not extremely swollen, circumstances are favourable.

where Mr. Pollock had tied the femoral artery, at St. George's ondary hæmorrhage came on, apparently from the upper end of the ı the eleventh day—the ligature not having separated, though it was In the absence of Mr. Pollock from London, I was sent for, and on with my colleagues, determined to attempt to secure the vessel, and

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iest period at which the separation of the ligature has been noted l case, free from hæmorrhage, appears to be the eighth day; but ıes away before the eleventh. In one case it came away on the t hæmorrhage occurred. In 91 cases out of 137 it separated before ı day; but it has been known to remain on the vessel up to the

rn. *Med. Sc.* Oct. 1849, n. s. vol. xviii. p. 313.

should this prove impracticable, to amputate. I succeeded without much difficulty in tying again the upper end of the artery, which was perfectly open, and the operation was so far successful; as hæmorrhage did not recur during the eight days which the patient survived. The cause of his death was phlebitis leading to pyæmia.

Renewed ligature of a tied artery is, however, a formidable and uncertain operation, which should only be undertaken as an exploratory proceeding, preliminary to amputation, if this should be found necessary. In all cases of severe secondary hæmorrhage, there seems little doubt that amputation is the safest measure for the patient, though it is one to which no surgeon would willingly resort.

A slight amount of gangrene is not always inconsistent with the preservation of the limb; while of the cases of more extensive gangrene, many are saved by secondary amputation. Six cases of successful amputation are recorded in Norris's table.

Porta's statistics give somewhere about the same mortality[*] as those of Norris. It may be said, however, that these statistics give an unfair view of the mortality, since many of the operations were performed by the older surgeons on exploded and unscientific principles; or that successful operations on the femoral artery are so common that they are not considered worth publication. But no such objections can lie against the statistics collected by Mr. Hutchinson[†] of the cases of ligature of this artery in metropolitan hospitals. Out of fifty cases sixteen have died, or, in round numbers, one-third. Mr. Bryant's tables of amputation of the thigh at Guy's Hospital for all causes,[‡] with which those collected by the present writer from St. George's Hospital[§] agree in all essential particulars, give a mortality considerably under one-third. So that ligature of the femoral artery seems to have proved more fatal than amputation of the thigh in the practice of London surgeons.

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[*] It would be wrong to quit the subject of the mortality after ligature of the femoral artery, without noticing the fact that Mr. Syme tied the artery twenty-three times in succession without any unfavourable symptom (*Principles of Surgery*, 1856, p. 99). Still, in urging this remarkable fact as an argument against the use of pressure, I cannot help thinking that that distinguished surgeon has been misled by a success which must be exceptional in the practice of any operator, however skilful.

[†] *Med. Times and Gaz.* vol. ii. 1856, p. 515; i. 1860, pp. 12, 35, 62, 63, [illegible]

[‡] *Med.-Chir. Trans.* xlii. 70.

[§] *Med. Times and Gaz.* vol. i. 1861, p. 358. See also *St. George's Hospital Reports*, vol. i. pp. 303, 4, where the mortality of amputations of the thigh for all causes is exactly one-third.

; the last few years, taking all cases of each operation riminately.

t be necessary to tie the artery in Hunter's canal, which, er, can only be the case either for wound or after the of the common operation, the same line of incision will de, but lower down; and it will be necessary to divide uscles freely. Hence the operation is more protracted loody, but no important parts are endangered in either. rincipal risk is of wounding the vein, or of including it saphenous nerve in the ligature.

Femoral Aneurism.

ntaneous femoral aneurism is regarded, with reason, as a serious affection than popliteal, since the latter often persons whose vascular system is in all other respects , while the former gives much reason to suspect a gene- theromatous condition of the vessels, in which case the nce of organic disease of the heart, or of internal aneur- exceedingly probable. Every such case, therefore, should efully examined with reference to these points before the ent is fixed. The diagnosis of an aneurism in the thigh rdly be attended with difficulty. Some doubt might exist the vessel upon which it was seated, whether the super- r deep femoral; but the doubt would not have much effect treatment. In traumatic cases, the diagnosis between and arterio-venous aneurism should be attended to; but h has been already said upon that point; what follows fer entirely to the treatment of common aneurism in the Rest, without any special treatment, has been known d to the spontaneous cure of a femoral aneurism;* but ld not be good practice to delay the commencement of active treatment beyond the day or two which is usually d in order to familiarise the patient's mind and body his novel circumstances, unless the tumour were visibly sing in size. In all cases in which the sac has not burst, ession of the femoral in the groin ought to be tried, and sually succeed, especially if there is opportunity for the l application of digital compression. Nor if the sac has is the case by any means desperate. A careful examination will show whether pressure with the finger controls the further progress of the extravasation; if it does, compression of the femoral may be tried for a day or two, the case being, however, very carefully watched. On the failure of pressure, recourse is to be had to the Hunterian operation,* which can generally be effected below the groin, in the first part of the artery; but in cases where the tumour extends higher up, the ligature must be placed on the external iliac. The former operation will be described here, the other being appended to the section on Inguinal Aneurism.

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* Luke, in *Med. Gaz.* May 9, 1845.

Ligature of the common femoral artery is an operation which is not generally regarded with much favour, and which is, therefore, little practised for the cure of aneurism, inasmuch as the operator generally prefers to tie the external iliac. The reason of the supposed danger of the ligature of the artery in this situation is, the proximity of the ligature to large branches. The epigastric and circumflex iliac on the one side, must come off near the ligature if it is placed close to the fold of the groin; and the profunda on the other, if it is placed lower down. The neighbourhood of these large branches would certainly appear likely *à priori* to lead to secondary hæmorrhage; but some doubt is thrown upon this theoretical conclusion by the experience of the elder and younger Porter, the latter of whom reports three cases fully, and alludes to two others, in which the operation was performed by himself and his father, all of which were successful.† Dr. Macnamara of Dublin, in a paper published in the *British Medical Journal* October 5, 1867, refers to eight cases; all but two being successful. In one of the unsuccessful cases (Mr. Butcher's) the patient died from hæmorrhage, which had occurred previous to the operation; in the other (Mr. Collis's) there was a high division of the femoral; the ligature had really been placed below the bifurcation (*i.e.* it was not a case of ligature of the common femoral at all): the patient died of secondary hæmorrhage.‡ To these cases must be added one under Dr. Gregson's care,§ in which the artery was much diseased. Secondary hæmor-

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[*] This is the ordinary rule; but in cases where there is not much anastomosis, and in some in which the diagnosis is obscure, the old operation may be performed successfully (see the cases referred to on pp. 457, 458).

[†] *Dublin Quarterly Journ. of Med. Sc.* Nov. 1860.

[‡] *New Syd. Soc. Biennial Retrospect,* 1867–8, p. 298.

Med. Press and Circular, Sept. 2, 1868.

took place; the external iliac artery was tied, but this ot control the bleeding; gangrene ensued, and the patient [*] But this operation has not as yet been performed suffi- ly often to allow of our pronouncing a confident judgment; it must be left to the discretion of the operator to select proceeding which he may think best calculated to save his ent's life. The ligature of the common femoral is certainly more easy and a less formidable operation primarily than of the iliac. The artery can usually be felt pulsating; nothing is necessary except to divide the soft parts over it fully with a moderate incision, so as to apply the ligature ich should be carried from within outwards) without any osure of the vein or other parts. The incision may be either gitudinal or transverse, and surgeons who have performed operation differ as to the relative advantages of the two sions. The crural branch of the genito-crural or a small ch of the anterior crural nerve may be found running down ont of the vessel, but can be easily avoided.

nother objection to which the ligature of the common oral is exposed is the liability to gangrene, in consequence he vessel being blocked up above the origin of both of the st nutrient arteries of the limb. The superficial femoral, ch nourishes the lower part of the limb, is comparatively ly reinforced after the ligature by its free anastomosis with profunda artery; but when both these channels are blocked the consequent strain upon the collateral circulation is ch increased; and, for my own part, I must express my ided preference for the ordinary operation whenever there choice between the two. Yet, if the aneurism were seated the thigh and the ordinary operation were impracticable, I uld prefer the ligature of the common femoral to that of the ernal iliac.†

Mr. Erichsen asserts (op. cit. vol. ii. p. 110), that out of twelve cases in h the femoral has been tied, only three have succeeded, the others having l in consequence of secondary hæmorrhage; and thinks that the operation ld be banished from surgical practice. But Mr. Erichsen has obviously ooked the recorded experience of the Irish surgeons.

In the year 1868 a patient was under my care in St. George's Hospital, hom Mr. Smyly of Dublin had tied the common femoral artery for the of popliteal aneurism in the groin. The operation had been perfectly ssful as far as the cure of the aneurism went; in fact, the latter was no er perceptible. But the patient had lost the second and third toes from

In Norris's table, above referred to, the femoral artery was tied twenty-seven times for aneurism in the thigh, with only five deaths; a smaller proportion than that of ligature of the femoral from all causes. Unfortunately, it is not told us in how many of these cases the artery was exposed above the origin of the profunda; which must, I presume, have been the case in some if not in most of them. The omission in so careful a compilation is doubtless due to the inadequacy of the original notes. In Porta's table, eight are said to have died out of sixteen; but no details are given.

Inguinal Aneurism.

Pulsating tumours are always to be viewed with some suspicion when they lie in close proximity to any bone possessing a copious diploe. Hence such affections about any part of the pelvis should always be very carefully examined before they are pronounced aneurismal. The records of surgery abound in instances of tumours in the gluteal and abdominal regions having been pronounced to be aneurism of the large arteries of those parts, when they were really pulsating cancers of the bone; and many of the cases reported by the older surgeons were obviously of this nature, though the mistake was never discovered, and they stand amongst the list of aneurisms. Such a mistake is less likely to occur in the groin, than about other parts of the pelvis; but the surgeon should be on his guard here also. A comparison of the pulse in the chief arteries of the two limbs will be of great service, since it is usually altered in aneurism and not in the pulsatile tumour; and the other points of the diagnosis between aneurism and pulsatile tumour should be carefully examined. (See p. 454.)

The diagnosis having been made, the question will occur whether the case is a fit one for compression, or whether the Hunterian operation must be performed. Compression on the external iliac, in persons not very fat, can be easily applied by the finger; and numerous instances of the success of digital

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gangrene, as well as some of the skin at the inner side of the foot; and the cicatrix had ever since been so unsound that it broke down into a torpid ulcer on any slight cause. This had been a source of constant misery and loss of activity to him ever since the operation. I should, however, add that there had been some ulceration of this foot and leg before the femoral was tied.

ssure in this region are recorded. In the face of such facts, surgeon would be doing his duty who exposed his patient to great risks of an operation on the external iliac artery, hout a well-considered and persevering attempt to cure the ase by pressure, whether digital or instrumental. In these urisms complete pressure, both proximal and distal, by ans of a tourniquet applied to the artery above and another ow the tumour, has been found extremely successful. The ient should be confined to bed for a few days, while the instru- nts are being got ready—for it is necessary to see that the npressors fit very accurately—and during this interval the y may be prepared by the application of digital pressure for the re serious endeavour to cure the disease. Then chloroform uld be administered, and the patient should be kept under its uence for the necessary length of time, whilst all circulation uspended in the sac by pressure on the external or if necessary common iliac above and on the femoral below.

n instance of cure of inguinal aneurism by this means is recorded by Dr. pother,* in which the pressure was applied on the first occasion for seven, on the second for twelve hours; and instances of cure by long-continued ipression between the heart and the aneurism only by Mr. Eck,† Mr. wson,‡ Mr. Hilton,§ and others. In the last named case, there was also liteal aneurism, which was simultaneously cured. I am informed, however, t in this last case the cure was not permanent in the popliteal aneurism, and limb was afterwards amputated in the country.

It is possible, also, that direct pressure upon the tumour may sist in the cure, as it seems to have done in Mr. Luke's case, ove referred to; but this should be used very cautiously, if all, since sloughing of the coverings of the tumour would st seriously complicate the case.

igature of the external iliac artery.—The operation for securing external iliac artery is usually regarded as a very successful ; and relatively to the other operations on large trunk vessels, nay be so considered; but the mortality is still very great. 153 published cases taken indiscriminately, forty-seven died; nortality exceeding that of amputation of the thigh.

The operation is performed by making a sufficient incision ough the parietes of the lower part of the abdomen, the cise direction of which is not a matter of very great conse-

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Dublin Med. Press, March 29, 1865.

† *S. Barth. Hospl. Reports*, ii. 190

Lancet, October 26, 1867.

§ *Med.-Chir. Trans.* vol. lii. p. 300.

quence, but which is usually drawn from a little above centre of Poupart's ligament outwards (so as to avoid direction of the epigastric artery) to a little internal to anterior superior spine, from which point it may be cur inwards, as far as may be thought necessary, towards t umbilicus; or it may lie directly over the course of the arter The muscles are to be divided to the same extent, care bei taken in dividing the lowest strata, until the transversalis fasci is reached. This structure can generally be recognised immediately beneath the muscles, and should be divided in the iliac fossa, not far from the anterior superior spine, upon a director, after a hole has been cautiously made in it. The operator will now find a cellular interval lying above the peritonæum; and that membrane, with the intestines, should be gently and gradually pushed over towards the middle line, until the vessels are seen or felt. The vein, it should be remembered, lies internal to the artery; and the genito-crural nerve, or lower down its genital branch, lies on the anterior surface of the vessel. The ligature, must, therefore, be passed from within outwards; and if the nerve have been included in it, care should be taken to slip the thread away from under it before the knot is tied. The ligature of this little nerve need not, however, lead to any bad results. The accident which usually happens in this operation is, naturally, the laceration of the peritonæum. It is not necessarily attended with fatal or even serious consequences; in fact, a successful case was lately published in which the peritonæum had been divided by mistake for the transversalis fascia to the extent of the external wound; but any injury to the peritonæum should nevertheless be most carefully avoided.

In principle, the various operations described on the iliac arteries reduce themselves to two methods, in one of which the artery is reached from below, which in the other it is approached from without or from above, as has been just described. The latter method is easier when the aneurism encroaches upon Poupart's ligament; the former when the tumour is situated lower down, and the whole of the artery may, therefore, be expected to be found healthy. There is little difference between the two plans, except that the operation from below requires a smaller incision, and is less difficult in appropriate cases; but if the artery is pressed back into the pelvis by a tumour extending up into the groin, it becomes much more difficult, if not impracticable, from adhesion between the tumour and the peritonæum. Sir A. Cooper, in describing the operation from below, advises that 'the centre of the internal oblique and transversalis muscles should be raised from Poupart's ligament. The opening by which the spermatic cord quits the abdomen is thus exposed, and the finger passed through this space is directly applied upon the iliac artery.' The rest of the operation then consists iefly in scratching the fascia off the artery, separating the latter from the in, and passing the ligature round it, which Sir A. Cooper directs to be done om without. Mr. Guthrie, however, justly observes, that the vein is less ely to be injured if the point of the needle be first insinuated between it and e artery, and the ligature carried from within outwards.*

The points to be chiefly guarded against in the ligature of he external iliac artery are, wound of the epigastric artery, of he vas deferens, or other constituents of the spermatic cord, aceration of the peritonæum, puncture of the external iliac vein or of the circumflex vein, ligature of the genito-crural nerve, and a too free disturbance of the subperitoneal cellular tissue. The wound of the epigastric artery is only probable when the operation is practised from below. The vessel can, it is true, be secured, but the bleeding and loss of time are objectionable; and after it is tied, an important anastomosis is stopped up, and he chance of gangrene increased. The vas deferens also is only ndangered in tracing the artery upwards. A knowledge of its osition, and its peculiar cord-like feeling, will suffice to make he operator avoid it. The laceration of the peritonæum cannot lways be avoided. Great gentleness should be used; and efore the operation the patient should have been well purged, n order to obviate any distension of the intestines. The clean xposure of the artery is the best safeguard against wounding he vein or including the nerve. The circumflex iliac vein which rosses the end of the artery must be avoided in the operation om below. A careful selection of the method most appropriate the case before him will enable the operator to reach the rtery with the least possible disturbance of the deep cellular ssue. It is true that it may become absolutely necessary to isturb a large extent of the peritonæum from its cellular conections; but this should always be avoided as far as possible, ince it greatly increases the risk of diffuse inflammation on one r the other side of the serous membrane.

In Norris's and Cutter's tables † of 153 cases of ligature of his artery for all causes, forty-seven died; out of these the ause of death is not stated in one, was doubtful in one, and in wo was unconnected with the operation; of the remaining orty-three, seventeen died of gangrene, and three of sloughing of the sac, nine of hæmorrhage, five of peritonitis, one of pelvic abscess, one of diffuse inflammation, three of prostration and exhaustion, one of pleurisy, two of tetanus, and one of delirium tremens. Two of the remaining cases were unaccounted for. In successful cases, the earliest period of the separation of the ligature was the tenth, the latest the sixty-second day. In fifty-two cases it came away before the twentieth day, and in thirty others before the thirtieth.*

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* Guthrie's *Commentaries*, p. 268.

† *Am. Journ. Med. Sc.* vol. xiii. 1847, p. 13; vol. xlviii. 1864, p. 36. There eems an error in Dr. Cutter's statement of his results. He tabulates 14 deaths, ut only reckons 13.

Abdominal Aneurism.

Many of the pulsating tumours which are found in the false pelvis are of a cancerous nature; many of those which are undoubtedly aneurismal are seated upon the aorta, too high for surgical treatment. Thus, both the diagnosis and treatment of such tumours demands the most careful consideration. I can add nothing on the general question of the diagnosis between aneurism and pulsatile tumour of bone to what will be found above; and will here merely remark that the points most likely to be marked as distinguishing a tumour of the os innominatum from an aneurism of the iliac or gluteal artery would be the presence of swelling on both sides of the bone, and the appearance of cancer-cells in the urine, together with the equal beat of the pulse on the two sides. It would never be agreeable or advisable to commence an operation on the iliac vessels without having plainly heard the aneurismal bruit. But Mr. Moore's case above referred to (p. 453) shows that even this symptom may be deceptive.

As to the treatment of an aneurism in the belly, three plans suggest themselves: the employment of compression to the artery above, the use of medical means only, or the Hunterian operation.†

The successful treatment of abdominal aneurism by compression was first carried out by Dr. Murray of Newcastle-upon-Tyne,‡ under chloroform; pressure being kept up on the first occasion for two hours and on the second for five hours, with permanent success. In a case under the care of Dr. Heath of derland,* pressure had been kept up irregularly for ten hours, when the t fainted under chloroform. The symptoms were as bad as ever. He urged to bear a final effort without chloroform. This he did, and at the of twenty minutes, when he declared he could bear it no longer, the rism had become solid and had ceased to beat.

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* A successful case of ligature of the external iliac with silver wire has been recorded by Dr. Martin in the *Am. Journ. of Med. Sc.* Oct. 1860 p. 580.

† The old method has been adopted here also; but its results, I believe, have been, and would always be, uniformly fatal.

‡ *Med.-Chir. Trans.* vol. xlvii. p 187. Dr. Murray speaks of the experiment of curing abdominal aneurism by pressure as one previously unthought of—not having met with the recommendation of the plan in the first edition of this work.

The Hunterian operation for abdominal aneurism may be ctised on the common iliac artery, or on the lower part of e aorta. In some cases it may perhaps be possible to secure e upper part of the external iliac for aneurism situated above e groin; but this operation has been already described.

The operations for securing all the iliac arteries are similar principle, and identical in most of their details. The same ision serves to reach them all—only to reach the common or ernal iliac the incision must extend further upwards, and st be longer, in consequence of the greater depth at which e internal iliac lies, and the higher position of the common ac. Hence the surgeon can determine during the operation hich vessel he will select, according to the extent of the mour and the appearance of the artery when exposed.†

In applying a ligature to the *common iliac*, the operator must member the situation of the large veins which run with the tery of each side; and he must be careful to look out for e ureter, both to avoid including it in the ligature (of which, wever, there is little risk), and to avoid doing it any other mage.

The common iliac may also be tied by an operation behind e peritonæum similar to that which is used in experimental erations on the lower animals for tying the abdominal aorta.

Sir P. Cramptom's case is well known, and his operation is good illustration of the method of reaching the artery from ove the tumour. An incision was made from the end of the t rib obliquely forwards and downwards to the crista ilii, and n curved forwards above and parallel to the crest of the um, terminating at the anterior superior spine. The muscles fascia transversalis were cut through at the bottom of the ision till the subperitoneal interval was reached, and then peritonæum being held back by the front of the finger, a be-pointed bistoury was run along the back of the finger, d so, by repeated strokes of the bistoury the muscles were ided to the extent of the external wound. Sufficient room s thus obtained to pass in the whole hand, and raise the

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Brit. Med. Journal, Oct. 5, 1867.

† Guthrie, *Commentaries*, p. 262.

gloomy, the recoveries having been only e
American Journal of Medical Sciences for Jul
Smith collected all the cases known ther
thirty-two in number,† of which only s
recovery; and in one case at least the pati
died under the operation. The causes of
nineteen cases; and it is remarkable that
alleged cause in only three instances; the ot
tion' eight, hæmorrhage six, and peritonit
ful cases, or cases uncomplicated by hæmo
may be expected to separate in about three

Ligature of the abdominal aorta.—Sir A.
first in which the abdominal aorta has been
The patient was suffering from aneurism
have involved the left common iliac arte
below it to some extent. It had burst throu

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* It is worth while to quote Sir P. Crampton's fo
parts were unobscured by a single drop of blood. '
artery, nearly as large as my finger, beating awfully,
minute, its yellowish-white coat contrasting strongly v
iliac vein which lay beside it, and seemed nearly doub
in its course to the bladder, lay like a white tape acro
process of separating the peritonæum, it was raised
which it remained attached.' (*Med.-Chir Trans.* vol.

† Dr. Smith has divided his cases into four groups:
rhage in wounds, or in surgical operations, eleven
recovered; 2, for aneurism, fifteen cases, ten deaths;
mistaken for aneurism, four cases, one recovery; 4, to c
operation in one case, and in an aneurism for anast

nt was greatly reduced by hæmorrhage. Sir A. Cooper avoured, by making a small puncture into the aneurism h he could plug with his finger, to reach the opening of artery, with a view of tying it on both sides of its comication with the sac—the operation since practised by Mr. e. But as he could not reach the vessel by this means, he rmined to give the patient the 'only hope of safety' which ined for him, by putting a ligature round the artery above tumour—the aorta. The operation was accomplished by ncision through the linea alba, three inches in length, its re corresponding to the umbilicus; the peritonæum was ed to about the extent of the skin-wound; the intestines, h were completely empty,* did not protrude; the finger passed down between their convolutions on to the spine, re the aorta was felt beating violently. The peritonæum then scratched through with the finger-nail, and the point he finger was insinuated below the vessel. The aneurismlle was then conveyed round the aorta, and the ligature . In doing this, great care was necessary, to avoid includthe intestine or omentum. Sir A. Cooper's patient survived hours; Mr. James's died the same evening. These cases, y nothing of the numerous instances in which the artery been successfully tied in the lower animals, certainly show possibility of survival after the operation; and accordingly operation has been repeated several times,† not, however, stley Cooper's plan, but by an operation similar in most ects to Sir P. Crampton's on the common iliac artery; is to say, by a free incision through the abdominal walls, ewhat far back, carried down to the fascia lining them, making a cautious division of this fascia to the extent he wound, gradually pushing over the peritonæum and stines, and directing the fingers towards the front of the e, where the pulsation of the great artery will easily be

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ir A. Cooper adds the remark, that in this operation it is essential to the bowels well emptied; and the truth of this observation was exem-l in the next case in which the artery was tied, by the great trouble ienced by the operator (Mr. James) in consequence of the tympanitic tion of the intestines. (*Med.-Chir Trans.* vol. xvi. p. 1.)

y Murray, *Med. Gaz.* 1834, vol. xiv. p. 68; Monteiro, *Schmidt's Jahrb.* ; South, *Lancet*, 1856, vol. ii. p. 222; M'Guire, *Am. Journ. of Med. Sc.* 1868, p. 415; and with a temporary compressor by Dr. Stokes jun., blin (see page 485).

felt. But though it is easy to feel the artery, there is much difficulty in getting the finger round it, and in separating it from the important parts which lie around.

Many most interesting questions present themselves in considering the justifiability of this daring experiment in operative surgery. Our space will not allow of their adequate discussion; but the main considerations must be summarily stated. First, is there really any rational prospect of recovery? One of the patients (Monteiro's) survived ten days, so that it would be rash to deny that there is. Still we must not forget that such an operation is never undertaken except upon a patient in the extremity of a disease probably affecting the whole arterial circulation, one in a very different condition from a healthy animal, or even a healthy man. Secondly, allowing the theoretical possibility of recovering, is the practical chance of it ever equal to that of spontaneous cure? Sir A. Cooper's case certainly was one, to judge by his description, in which such a cure was impossible, since he had laid open the tumour in an unsuccessful attempt to perform the old operation; and hæmorrhage must soon have occurred, and could hardly have failed to prove instantly fatal, so that some operation was inevitable. But, thirdly, is it ever necessary to secure the aorta itself? Mr. Guthrie believes, on the contrary, that when an operation is possible, the common iliac artery above the tumour could always be reached by making the incision on the opposite (sound) side, as if to tie the common iliac of that side, and then passing over from that artery, when it has been found, to the one on the side of the disease.* The old operation might be attempted, but would be very liable to fail, from the fact of the sac passing into the pelvis, and so perhaps pressing the opening of the artery out of sight; or galvano-puncture might be tried in a case which seemed suitable for it. In such desperate circumstances probably any treatment would be unavailing to prolong life; but the risk of doing harm by any treatment is not great, since the patient's life will not last under any circumstances more than a few days. On the whole, however, the natural repugnance of surgeons to perform great operations which cannot be expected to succeed, will either banish this altogether from practice, or restrict it to a very few exceptional cases.

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* *Commentaries*, p. 265.

Gluteal Aneurism.

ating tumours in the buttock, of spontaneous origin, are found to be of a cancerous nature, and connected with nominate bone; but aneurism of the gluteal or sciatic may occur unconnected with wound, and in the Museum College of Surgeons there is a preparation by John r of an aneurism of the internal pudic artery. The sis, however, should be very clearly established before tremely dangerous measures necessary for the treatment eal aneurism are recommended. The points to which al attention would be directed would be, whether any r is present in the iliac fossa; whether the bruit is of e aneurismal character; whether any bone can be felt in relope of the tumour; whether the pulsation resembles aneurism (expansive) or that of pulsatile tumour (rapid aving); and, finally, whether any sign of constitutional n can be detected. Mr. Guthrie's case,* however, shows e greatest experience in aneurism cannot always insure errors of diagnosis.

e existence of aneurism appears certain, two courses en to the surgeon; viz. to perform the old operation e precautions against sudden and excessive hæmorrhage Mr. Syme adopts, or to tie the internal iliac artery. rmer course can only be recommended when the aneurism raumatic origin, since in that case the artery will be and the wound in it will be within reach; while in a neous aneurism, besides the risk of putting the ligature n unsound artery (which, under the circumstances, is a consideration), the orifice of communication may be the pelvis, and the old operation absolutely imprac- Mr. Syme relates an example of each form of m,† and each method of treatment, which was successful instances. No further description is necessary here of me's method (or revival of Astley Cooper's method) of ing the old operation, as it has been already described 60. I shall, therefore, proceed to describe the ligature internal iliac artery.

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* *Med.-Chir. Trans.* vol. xxviii. p. 308.

† *Obs. on Clinical Surgery*, 1861, pp. 165–173.

The internal iliac should only be tied for aneurism o its branches, or for a wound within the pelvis in which will not stop the bleeding. In this case, however, the op which is one in itself of great danger, should be practi after very careful deliberation. The artery has been se order to stop hæmorrhage from a wound in the butto the practice has been justly censured by Mr. Guthrie.*

The operation much resembles that above descr placing a ligature on the common iliac (see p. 615). H the steps there prescribed, arrived at the lowest point, cation, of the common iliac artery, the operator mu down the internal iliac into the pelvis, his finger b across the external iliac vessels, which may, if it be pr be shielded by a curved spatula from all chance of inju desirable to place the ligature at a distance of about below the bifurcation. The vein lies behind the arte spot at which the ligature is to be placed having been surgeon scratches the artery free from its connections finger-nail, and then proceeds to pass the ligature; which Mr. Guthrie says that it is desirable if possi the vessel, and for this purpose directs that the li wound be retracted. The artery, however, lies at s depth that it can only be brought into view if the spare. Great care accordingly is required to avoid the peritonæum, the ureter, and the vein which ac the artery. The termination also of the inferior vessels (superior hæmorrhoidal) may be injured in op the artery of the left side.

The cases in which this operation is required mu rare. Of seven cases contained in the *American* *Medical Sciences* (vol. xiii.), three recovered, and Mr. Syme's successful case is to be added to the reco a case by Mr. Atkinson to the list of deaths; † so tha ation has been sufficiently successful to encourage its

T. HO

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* *Commentaries*, p. 270. † Erichsen, op. cit. p. 107.

‡ The Sections on Digital Pressure, Manipulation, Galv Coagulating Injections, Arterio-venous Aneurism, and Cirsoid re-edited from the originals written by Mr. Hart.

NOTE TO THE ESSAY ON ANEURISM.

LIGATURE OF THE LEFT SUBCLAVIAN IN THE FIRST PART OF ITS COURSE.

SINCE the foregoing essay was in type, I have been favoured, by the kindness of Dr. Lewis Sayre of New York, with the particulars of the case referred to on p. 566 (note), in which Dr. J. Kearney Rodgers of that city tied the left subclavian artery within the scalenus muscle. The case will be found detailed in the *New York Journal of Medicine* for 1846.

The patient was a man aged 42; the disease had existed for four months, and formed a pulsating tumour the size of a small hen's egg, rising about two inches above the left clavicle, extending externally to the outer third of the bone, and internally covered by the outer edge of the sterno-mastoid muscle. The cutaneous veins were very much enlarged over it. He was troubled with severe pain, preventing sleep, down the course of the nerves of the brachial plexus, and the arm and hand were œdematous. The pulse was unaffected. He was kept under treatment, chiefly by means of venesection and digitalis, for a month, but the tumour steadily increased, and the man's sufferings were so acute as to render him anxious to submit to any operation, however dangerous. At a consultation, the surgeons present, of whom Dr. Mott was one, declined to recommend the operation, but left it to Dr. Rodgers's judgment, who operated on October 14, 1845.

He thus describes the operation:—

'An incision was made three inches and a half in length on the inner edge of the mastoid, terminating at the sternum, and dividing the integuments and platysma myoidea.

'This was met by another extending along the sternal extremity of the clavicle, about two and a half inches. This last incision divided a plexus of varicose veins passing, in the integuments covering the clavicle, to the subclavian. Free bleeding taking place from their cut and patulous extremities, it became necessary to check it by ligature.

'The flap of integuments and platysma myoides was now dissected up, and the lower end of the mastoid laid bare; a director was passed under this muscle, and the sternal portion and half of the clavicular divided by the bistoury. This muscle was now turned up, and the sterno-hyoideus muscle, the omo-hyoideus, and the deep-seated jugular vein were seen covered by the fascia.

'On turning up the mastoid, a portion of the aneurismal sac strongly pulsating was brought into view, overlapping about half the width of the scalenus, forming now the outer part of the track through which I was to pass; showing fearfully one of the dangers of the operation, which from my previous examinations of the part, I had of course anticipated.

'The fascia being divided by the handle of the scalpel and the fingers, I passed in contact with the deep jugular on its outer side to the inner edge of the scalenus anticus, intending, for the purpose of avoiding as much as possible all danger to the thoracic duct, to reach this muscle fully half an inch above the rib, rather than at its insertion. I now felt distinctly the phrenic nerve running down on the anterior surface of the scalenus, and was confident that I should be able to avoid any injury to it. Having attained the inner edge of the scalenus anticus by pressing downwards with the finger, I soon discovered the rib, and after some little search easily found the subclavian artery. By pressing it against the rib, all pulsation ceased in the tumour, and by removing the finger pulsation returned.

'I now felt that great care was necessary to detach the artery, and avoid danger to the pleura and thoracic duct. In accomplishing this part of the operation, I at first tried Sir Philip Crampton's instrument, but ascertaining that I could better carry the ligature around the artery, and bring up its end, by the invention of Drs. Parish, Hewson, and Hartshorne, of Philadelphia (long since given to the profession by them, and lately claimed by Mr. L'Estrange of Dublin), I accordingly adopted that instrument.

'This part of the operation, it will be imagined, was not very readily accomplished. The great depth of the vessel (nearly the length of my finger) and narrowness of the wound, prevented a very easy management of instruments. The point was introduced under the artery, and soon directed upwards so as to avoid injury to the pleura. I readily tied the ligature, and tightened it with the forefinger in the bottom of the wound. All pulsation immediately ceased in the aneurism and the arteries of the extremity.

'The patient complained of no pain or unusual feeling in the head, as might have been expected from so suddenly changing the current of so large a quantity of blood.'

He went on well, with the exception of a slight erysipelatous attack, until the tenth day (October 23), when a cough came on, and he complained of flashes of light before his eyes; the left pupil was noted as being contracted; and on the following day ptosis came on on that side. Secondary hæmorrhage commenced on the thirteenth day, and proved fatal on the fifteenth.

Post-Mortem Examination eighteen hours after death.

The wound was filled with coagula and sponge, which had been introduced for the purpose of making pressure. The blood was already in a state of partial decomposition.

The dissection was carefully performed, exposing the different layers of muscles. The lower incisions made at the operation were found to include three fourths of the mastoid, leaving a small portion of the clavicular portion undivided.

Below this the aneurismal sac and the scalenus anticus formed the outer and posterior wall of the wound. The inner wall was formed of condensed cellular tissue covering the carotid artery, jugular vein, thoracic duct, and the edges of the thyroid muscle.

tom was the subclavian artery, completely divided by the ligature, und free in the coagula. The cellular tissue of all the parts around ras condensed by adhesive inflammation, rendering the dissection tedious and difficult. The jugular vein, which skirted the inner ound, was obliterated and filled with fibrinous coagula.

he track of the ligature the vein was contracted to a cord, and s far as its junction with the subclavian. The vena innominata n were normal.

at the bottom of the wound presented a large irregular lacerated municating from the wound with the left pleural cavity, which h coagulated blood. This formed one large uniform coagulum, ry appearance of being of rapid and recent formation; the round was thickened. On exposing and tracing the subclavian found that the ligature had been applied about one and a quarter ts origin at the aorta, and immediately at the root of the vertebral, side. The artery had been completely divided by the ligature, ntioned above was found loose in the wound. The stump of the etween the aorta and ligature, presented the appearance of a ord, about an inch and a quarter long, and impervious to liquids

al coat of the stump was thickened and adherent near the ligature nding tissues, by adhesive inflammation. On laying open the vessel y it was found that a firm fibrinous coagulum occupied the vessel, rent firmly to its inner coat for three-quarters of an inch; near the agulum was softer. The coats of the vessel were moderately d presented a small patch of atheromatous deposit about the third om the tied end. Around this deposit the adhesion seemed as any other part.

e ligature, the artery presented a different appearance. No plug soft coagulum of blood occupied its cavity, and it presented much of adhesive inflammatory process in its coats. The vertebral was ediately at the point of ligature, and was open, containing a thin m like the one in the subclavian. These were drawn out with lently had formed during the last moments of life.

third of an inch from the vertebral was the internal mammary. were all patulous and healthy. About half an inch from the ommenced the dilatation of the artery to form the aneurismal sac. r was about the size of a small orange, and had involved in its f the scalenus anticus, the cervical nerves going to form the cervical rrounding cellular tissue, and the glands. The aneurism was comd up with coagula, and the axillary artery which emerged from was plugged with a fibrinous clot exactly similar to the one in the subclavian, though perhaps not so perfect. It appeared however, to obliterate entirely the calibre of the vessel. The some distance down the axillary artery.

ic duct, which had been injected with wax from the abdomen, njured. The aorta was thickened, and its coats irregular from a eposit of atheromatous matter in its tissues.

vas somewhat larger than natural, but apparently sound. The vere not examined.

'I had always considered it as a perfectly jus
a careful surgeon conversant with anatomy co
were of moderate size.

'The want of success in the four or five operat
its first stage did not discourage me, nor did they

'The difference in the anatomy of the right and
that I did not consider it fair to argue that a simi
left side.

'The greater depth of the left, indeed, rendered
but, if accomplished, not less likely to succeed.

'The point where the ligature must necessarily
is but a quarter or at most half an inch from the
off of the carotid, so that it could scarcely be exp
form sufficiently firm to adhere to the vessel, and
action. Besides, too, the greater force of the circ
additionally unfavourable to success on that vess
tional reason for distrusting an argument drawn
two.

'In examining anatomical and surgical authori
valent among almost all British authors, that t
was "impracticable."

'Colles, the eminent Irish surgeon who first tie
first stage, says: "This operation, difficult on th
practicable on the left subclavian. For the gre
which this vessel is placed, the direct course whi
top of the pleura, the sudden descent which it
the protection of the clavicle, and the danger of i
the eighth pair of nerves, the internal jugular v
run close to and nearly parallel with this artery
combination of difficulties as must deter the m
undertaking this operation on the left side.' (Edi

'The opinions of those eminent anatomists and surgeons being so decidedly against the possibility of the operation, it was only left for me to examine with great care the surgical anatomy of this vessel.

'Having had the thoracic duct injected with wax, I repeatedly dissected the parts concerned, and operated in every way that suggested itself to me as likely to present any advantage.

'My opinion of its feasibility was thus confirmed, and having never entertained any doubts of its propriety, I accordingly undertook it.

'I regret, indeed, deeply, the death of my patient; but the appearances presented on examination after death have only strengthened the opinion I had previously formed, and have encouraged me to undertake it, with some slight variations, should another case ever present itself.

'It has often happened with important operations that many of the first cases have been unsuccessful, while the carefully noted observations made on dissection have led to different modes of operating, and more uniform success.

'Previously to the performance of this operation, many entertained doubts whether the force of the circulation so near the heart in so large a vessel would not prevent the formation of a coagulum, and of course interfere with the obliteration of the vessel. These doubts have now been removed, and I consider that all reasonable objections fall with them, except those arising from the anatomy.

'Danger to the thoracic duct and pleura are, in my opinion, the most serious of these, for, with ordinary coolness and care, there will be little danger of including the pneumo-gastric and phrenic nerves, or carotid artery, in the ligature. The veins may be lacerated by great roughness, but can scarcely be included.

'The thoracic duct, I think, can almost always be avoided by reaching the inner edge of the scalenus half or three-quarters of an inch above its insertion, and then pressing the finger down towards the rib. The duct is thus kept out of the way of laceration by the finger, and afterwards by the aneurismal needle. I am aware that this duct varies in its course, but this direction I am confident will usually secure its safety. By adopting it in the many times I operated and dissected the parts in the dead body, it was uninjured.

'The artery lies in contact with the pleura, the laceration of which might be attended with very distressing and dangerous consequences.

'A careful introduction of the aneurismal needle, and soon turning up its point, will usually secure the safety of this membrane. In none of my operations on the dead body, where it was performed in this way, was it injured.

'The hæmorrhage in this case came from the distal end of the artery, and the very free and direct anastomosis of the internal carotid at the base of the brain with the vertebral, induce me to think that it was the latter vessel which transmitted the blood. Some indeed may have come through the thyroid axis, but I consider the former mode more direct.

'Should this operation be repeated, I would suggest securing the vertebral, and if possible the thyroid axis, by ligature.

'The difficulties are indeed thus increased, but not insurmountable.'

I have had the greatest pleasure in laying the history of this case (which is too little known in England) before the readers of this work. Whether it justifies the operation in any given case must still be a matter of individual opinion. It certainly shows the opinion ordinarily entertained of the impracticability of the operation to be erroneous; but we cannot avoid seeing that the difficulties, and even the anatomical dangers of the operation (terrible and almost insurmountable these latter are *) do not exhaust the objections to the proceeding. For in this as in all previous cases which survived those dangers, the cause of death has been secondary hæmorrhag Dr. Rodgers's suggestion of tying the large branches which co off near the distal side of the ligature, is eminently worthy trial. Still more is it to be hoped that some method may found for obliterating arteries without dividing them. If latter desideratum could be realised, I should expect the lig of these great arteries (innominate, first part of subclavian, possibly abdominal aorta) to take its place among the recog and successful operations of modern surgery.

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* In this very case, if I read the account right, the probability is pleura was opened during life. It is true the pleura has been known to been opened in operations on the subclavian arteries in cases which have theless proved successful (vide p. 560).

T. H.

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Achillis give way rather than the fib
loss of its vital contractile power, m
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muscle is more easily ruptured than
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and not of the tendons, takes place.

Though muscle in the livin
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the rectus femoris was ruptu
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having died from inflammatio
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recti abdominis were ruptured
man, in the struggle to save a
from a platform.

It more frequently happens
are ruptured, and this usuall
Muscles are sometimes torn
muscular spasm, as in tetanus.
muscle, from the violence of
considerable swellings.

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* Wardrop, *Med.*-

FECTIONS OF THE MUSCULAR SYSTEM.

LTHOUGH muscles are so much exposed to accidents and violence, they are not readily injured; nor, considering r high organisation, are they frequently the seat of disease. cles may suffer from contusions, strains, rupture, and nds of different kinds. Severe contusions are frequently wed by temporary loss of power in the muscle; this, to- ber with the extreme pain in any attempt to move the part, ticularly in the neighbourhood of the large joints, some- es leads to the suspicion of more serious injuries, as fracture lislocation. Strains of muscles are often followed, especially later life, by pains of a lasting and troublesome character, taking of the nature of rheumatism. Muscle may be tured either from external violence or from the too ener- c action of its own fibres; this latter occurrence is by no ns a common one, especially that in which the entire cle is torn across. In the living body, muscle offers a ter resistance to a force tending to rend it than either lon or bone; and when it does give way, it is for the most t at its point of junction with the tendon. Sédillot* says, t in twenty-eight cases of rupture of muscles, thirteen were tured at this point.

he power of resistance in a sound and healthy muscle in a state of full city is enormous; and many interesting comparisons and calculations on subject will be found in Borelli, *De Motu Animalium*. Percy† relates the of a person with wry neck, who was suspended by the head, with a view utting the muscle on the stretch; the result was separation of the muscle its insertion, but no laceration of its fibres: and in a case in which the nb was torn off, the tendons were drawn out, but the muscles were left jured, except at the point of junction with the tendon. We are all

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Mém. sur la Rupture musculaire; Mém. et Prix de la Soc. de Méd. de , 1817, p. 115.

Journal général de Médecine, vol. lxi.

ECTIONS OF THE MUSCULAR SYSTEM

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man, in the struggle to save a tray of ceme
from a platform.

It more frequently happens that a few fib
are ruptured, and this usually occurs in t

a case of acute traumatic tetanus, under Larrey, the man was immersed ld baths, after each of which the convulsions and muscular contractions most severe, and he died in three hours; a swelling, however, had been ously observed below the umbilicus, on the right side. On a post-mortem ination, it was found that the tumour was occasioned by the retracted of the rectus, which was entirely torn across. The space between the ends of the muscle was filled with blood. Mr. Curling describes a case in h portions of both recti abdominis were ruptured by tetanic convulsions of the specimens is in the Museum of the College of Surgeons). Mr. exhibited, at the Pathological Society, the rectus muscle of a patient had died of tetanus, in whom almost complete transverse laceration of the le had taken place. In Mr. Earle's case of tetanus, described in *Med.-* . *Trans.* vol. vi., one of the psoas muscles was partially ruptured. Boyer es the case of a strong man admitted into La Charité with 'bilious fever;' metic was given him, and whilst vomiting, acute pain was felt a little w the middle of the left rectus abdominis muscle. On examining the part, e was neither tumefaction nor discoloration of the skin, but an indentation, which the fingers could be placed, was felt. The man died; and the le was found completely torn across, the two ends being an inch apart, and space between filled with blood.

he rupture of a muscle is accompanied by extreme pain, mbling that occasioned by a smart blow from a whip or k, and often by a distinct sound like the snapping of a d; all motion of the part is either impossible, or is accomied by such severe pain, with spasmodic twitching, as to se the patient to desist. If the muscle be a superficial , a deep indentation will be found at the seat of rupture, duced by the retraction of its divided ends; and often a siderable swelling, proportioned to the vigour of the contion of the torn fibres, as in tetanus; and as there is always ravasation of blood, much discoloration of the skin will ow. The indentation and extravasation are not apparent, vever, in ruptures of the deep muscles, by which their gnosis is rendered less clear. If the rupture be discovered ly, and judiciously treated, a sufficient approximation of the ided ends will result, good union will follow, and the function the muscle will be restored. If, on the other hand, it be rlooked or maltreated, or if it occur in a part where proper asures cannot be employed to approximate the ends of the scle, as in some parts of the trunk, in ruptures of the deep scles about the hip and shoulder, &c., it will be found that a e separation exists, and that the ends of the muscle instead uniting, have become attached to the parts in the immediate ghbourhood, and the use of the muscle is consequently lost.

The treatment consists, 1st, in placing and retaining the part in a position most favourable for relaxing the muscles; and 2ndly in approximating the separated ends to one another by even compression, which we know exercises so great a power in controlling and modifying the excess of contraction in the muscles in fractures, &c. As regards the first, this is easily accomplished in the limbs: thus in rupture of the rectus femoris the knee is straightened, and the limb is raised to an angle with the body, as in fractured patella; but where the rupture occurs in the trunk, this cannot be done so readily; yet in the case above mentioned, in which both recti abdominis were ruptured, a good union was effected by keeping the patient in a sitting posture, the body being bowed forward, together with proper bandages.* The second is accomplished by an even and uniform compression of the muscles by means of carefully-applied flannel bandages or laced belts, aided in some cases by a strip of leather or gutta-percha. At the end of from a fortnight to three weeks, the union is generally completed. The process of union is similar to that of other structures; the effused blood is absorbed, plastic lymph is poured out, which assumes by degrees the firm and resisting character of tendon, muscular fibre itself being never reproduced. When a muscle, with the integument and parts around, is divided, it retracts to a greater extent than when the muscle alone gives way, from being deprived of its collateral support. This, in conjunction with an open wound, renders it extremely difficult to approximate the retracted ends of the muscle, and to find means for retaining them in a proper position; hence it will be found that wounds extending through muscles are followed by nearly complete loss of their use, the great chasm between their ends being filled up by granulations. It is recommended to endeavour to bring the ends together by sutures. These, with a position favourable for the approximation of the ends, and such encircling supports as can be employed where a wound is present, may do much towards restoring the muscle to a certain amount of usefulness.

Inflammation of muscle.—Independently of rheumatism, muscles may be the seat of inflammation from various causes, both simple and specific, which may terminate in abscess, or in some morbid changes of structure, to be described hereafter. Inflammation followed by abscess occurs occasionally in the parietal cles of the abdomen, arising either from some injury or out apparent cause. It appears first as an extremely pain- and more or less circumscribed swelling, distinctly felt w a portion of the muscular planes: after a time obscure tuation is perceived; pain is now very great, especially on least movement, accompanied by irritative fever. On laying n the abscess, pus, discoloured and somewhat offensive, apes, the symptoms quickly subside, and the cavity readily up and heals.

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* Richerand, *Nosographie chir.* vol. ii.

urulent deposits in the pectoral muscles, extending to the intercostal cles and diaphragm, occurred in a case described by Mr. Hacon in *Path.* s. vol. v. p. 329. The patient had rigors and other symptoms of fever ten before his death, with great pain in the right hypochondriac region; for- ion of matter was suspected, and pus followed the introduction of a needle. re were no purulent deposits in any viscus.

econdary deposit of pus sometimes takes place in muscles as well as in er structures. A case is given of phlebitic suppuration in muscle, originating what he terms puerperal rheumatism, by M. Cruveilhier.*

Inflammation may occur in muscles as a symptom of secon- ry, or rather tertiary, syphilis. In a paper read before the yal Medical and Chirurgical Society in January 1845,† Mr. tum described a group of three cases, two of which were as- ciated with other symptoms of constitutional syphilis, whilst history of the third case was obscure. The disease, which he d not seen described before, appeared in the form of rounded largements in the left sterno-cleido-mastoid muscle; there re three swellings in two of the cases, and two only in the her; in one of these there was also an enlargement in the ndinous origin of the muscle; the tumours were evidently med in the substance of the muscles, and were nearly of the e of a pigeon's egg, and gave a singular beaded appearance the muscles; there was stiffness, with much tenderness, in part, and great pain when the muscle was in action; the n was neither adherent nor discoloured; the disease was v in its progress, and had remained nearly stationary for e months. All the cases occurred in females, probably from neck being more exposed than in men; in each case the cts of the iodide of potassium were manifest. In the first e the patient obstinately refused to take the iodide of assium, in consequence of which mercury and various other nedies were tried without any good effect. After some time

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* *Path. du Corps humain*, fasc. 17.

† *Lancet*, Feb. 1, 1845, p. 136.

she consented to take the iodide of potassium; from
three grains were administered thrice daily, and the
ointment was applied externally; the tumours soon be
diminish, and in less than six weeks completely disap
The other two cases were similarly treated, with co
success; but in one of them the patient was obliged to le
the remedy for a time, during which it was remarked t
tumours became stationary; on her resuming the m
however, all remains of the disease quickly left her.
constituted the swellings could not of course be asc
from these cases; but a case occurred some time after, i
there was a tumour in the middle of the biceps muscle,
and defined as to induce the surgeon to proceed to its
by operation, when, on cutting into the fibres of the mu
tumour was visible, but the muscle in that part was co
and infiltrated with a grayish kind of lymph, great
which oozed away with much blood, all the swelling s
and the wound healed, leaving no enlargement. Mu
has been thrown upon the nature of these affections of t
cles and the changes they undergo by M. F. Bouisson o
pelier, under the title of *Tumeurs syphilitiques des*
According to him, both tendons and muscles are the
syphilitic tumours and contractions, which occur in
tion with other symptoms of constitutional syphilis.
observed these tumours in the glutæus maximus, th
trapezius, the sterno-cleido-mastoideus; also in the
structure of the tongue, lips, and pharynx. With regar
treatment, he for the most part found the iodide of po
given internally, with the external use of the iodine o
very effectual in removing the tumours, except those
tongue and pharynx, which were very obstinate; in the
the muriate of gold, in doses of from $\frac{1}{16}$th to $\frac{1}{8}$th of
was given with success. M. Bouisson was fortunate in
opportunities of seeing this disease in its advanced st
well as the stage above described. He found the enla
continue with little change, except under the treatmen
iodide of potassium, &c., for a considerable period. Se
the tumours presented an infiltration and deposit betw
fibres of a gray plastic exudation; many of the muscul
were nearly colourless. This state may be followed eith

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* *Gazette médicale de Paris*, July 1856.

ming of the effused matter and its conversion into a kind of laginous fluid, or may form an abscess, which, on slowly ing to a head, may burst, and leave an unhealthy ulcer with ghy surface and foul discharge. Some of these enlarge-ts, instead of suppurating, harden and become converted cartilaginous or even bony structure.

case is described in the *Gazette des Hôpitaux*, January 16, 1858, of a ur involving nearly the whole length of the sterno-cleido-mastoideus le. When the muscle was contracted, the swelling was immovable, but a relaxed state it could be moved on the deep plane of fibres; the skin, gh not adherent, did not slide readily over it as natural, and there was a t blush on it; there were dull pains in the part, which occurred at tain intervals, not more by night than by day; neither respiration nor tition was impeded. There were decided traces of old constitutional ilis, as in most of the cases reported. The patient was about to undergo a se of the iodide of potassium.

ometimes these swellings assume the form still more com-ely of defined tumours.

Robert[*] describes a case of a tumour which formed in the calf of the t leg as large as an egg, hard, unequal, and lobulated on the surface, some-t movable, tender to the touch, but not painful, which was completely d by the iodide of potassium. In *Path. Trans.* vol. vii. a very interesting unt of a tumour is given by Mr. S. Jones; the tumour was removed by South from a patient in St. Thomas's Hospital, November 6, 1855. The ent had had syphilis eight years before, when he took mercury, but had no titutional symptoms. He had received a blow on the left shoulder two years iously, and lost for some time the use of the arm; he, however, gradually vered it after some months. He had pains in the shoulder, which were idered rheumatic, and were treated and cured by the iodide of potassium; s also presented themselves at several points, but they disappeared. Violent s again came on in the shoulder, which were followed by a tumour in the -spinal region of the scapula; this increased rapidly in size; his general h suffered considerably. The tumour was well defined, moved only with capula, did not project much above the surface, and measured 6½ inches in direction, and 8 in another; it was removed with a large portion of the la. On examining it, it was found to be formed in the muscles, but ipally in the infraspinatus, though nodules were found in many of the bouring muscles. The tumour was mostly hard and dense, slightly c, of a dead white colour, and of a homogeneous or slightly reticulated ture; the surrounding muscular fibres were directly continuous with its e, and muscular fibres were present in great abundance in many parts of umour. Many of the fibres, examined by the microscope, had lost their ed character, and had become glistening, transparent, and structureless. spaces between the fibres were occupied almost solely by cells. Mr. South ince informed me that the wound healed well, and there has been no sign turning disease.

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[*] *L'Union médicale*, No. 37, mars 29, 1839.

Simple contraction, or shortening of a muscle without ap alteration in its structure or change from its normal con seems to be an occasional effect of the inflammatio syphilitic poison in the system, and is usually found muscles of the arm or fore-arm. M. Ricord has noticed long ago as 1842.*

M. Notta, in an interesting paper on Syphilitic Muscular Contraction three cases, the features of which were much the same; and in each th was the seat of the contraction. There was no hardness or rigidity muscle when not in action; the pains were variable, being great on putt muscle on the stretch, and mostly referred to its insertion. The con was slow, and gradually reached a certain point, causing fixed flexion elbow. The iodide of potassium, with minute doses of the proto- appears to have cured every case. The same may be said of the cases Ricord ‡ and others, in which there was a certain change of structure muscle, associated with contraction. As a general rule, mercury has good; in fact in many of the cases the disease appeared to increase wh patient was undergoing a course of mercury.

Muscular atrophy.—Muscular tissue is frequently subj atrophy, which may consist of one or more of the foll alterations:—

1. Simple atrophy.
2. Atrophy with granular degeneration.
3. Atrophy with fatty degeneration.
4. Atrophy with (the so-called) waxy degeneration.

In *simple* atrophy the degree of wasting of the mu tissue varies considerably. Generally, the fibres, alth paler and reduced in diameter, retain their anatomical racters. The transverse and longitudinal striæ are well ma the sarcolemma preserves its usual delicate and transp appearance, and the nuclei it contains are not increas number. Such is the form of atrophy met with in chroni exhausting diseases; in cerebral paralysis; after contus compressions, and affections of the joints. In many dis however, both acute and chronic, simple atrophy, or wasti the muscular fibres, is accompanied, in a greater or less de by one or more of the degenerations above mentioned. is sometimes the case after acute fevers, particularly ty typhoid; after alcoholism, lead-poisoning, rheumatism, &c. there is another form of this malady, which is known by name of *progressive muscular atrophy* (Cruveilhier), *atrophie culaire graisseuse progressive* (Duchenne), and *wasting palsy.* s curious disease differs in several respects from the atroies above mentioned. It is always chronic, but of uncertain ation; is frequently hereditary; is capricious or irregular its invasion; prone to spread from one part to another, or ome general, and thus go on to a fatal termination. The cted muscles suffer different degrees of wasting, and assume variety of aspects. Even in the same muscle, bundles in erent stages of atrophy and degeneration may be found the side of others that have retained their normal state. hen the wasting is extreme in all the bundles, a long muscle ay be reduced to a mere fibrous and cylindrical cord, or to a nd of tendon, and a flat muscle may be reduced in the same anner to a kind of membrane. In some instances the atrophy ay be *simple*, that is, the muscular tissue may be wasted to a nsiderable degree without any granular or fatty degeneraion;* but generally, one or both of these alterations of strucre is found to exist to a greater or less extent. The muscle lso changes and varies in colour according to the nature and egree of the atrophy. It is paler than natural; occasionally is quite colourless, like the flesh of fish; or it may have a faint ellow or ochreous tint. Its consistence for the most part is creased in consequence of the increase of the interfibrillar nnective tissue. When examined under the microscope, the ected muscles may be seen to have lost to a variable extent d degree, or even entirely, the appearance of transverse and gitudinal striation, while in a corresponding proportion the cous or muscular element is transformed into granules, which, some instances, are too fine to be distinguished as separate ticles. The granules are soluble in acetic acid.

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* *Gaz. des Hôpitaux*, p. 98.

† *Archives générales de Médecine*, sér. 4, vol. xxiv. p. 413.

‡ *Gaz. des Hôpitaux*, 1846, p. 1.

ranular degeneration or disintegration of the muscular tissue y exist alone; but frequently it is accompanied by fatty eneration, or may only form the first stage of the latter nge.

atty degeneration.—This morbid process may make its ap- rance in the muscular tissue at once; or may follow, accomy, and altogether replace the granular change. Besides this transformation into fatty *particles*, fat-cells in unusual, and sometimes in great numbers are found between the fibres, either collected into groups, or disposed in linear succession, like rows of pearls. These cells may multiply in proportion as the muscular tissue disappears, so that, when the fibres are reduced to mere filaments, there may be no loss of volume in the limb. An interesting case of this description is related by Mr. Hallett.* The degenerations seemed constantly to have commenced on the surfaces of the muscles, and extended inwards to their centres; so that many which appeared wholly converted into fat, exhibited, in their interior, muscular fibres in a more or less healthy condition.

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* Charcot, Hayem, Lockhart Clarke.

Waxy or vitreous degeneration.—This structural change was first described by Zenker.† It is called by the French pathologists, *vitreous* degeneration.‡ According to Zenker, it is observable only in the voluntary muscles, and never attacks all the bundles of the same muscle. The essential change of structure consists of a transformation of the muscular tissue into a homogeneous, colourless, and glistening substance, in which the transverse and longitudinal striæ, together with the nuclei, have entirely disappeared. This kind of degeneration is more common after acute diseases, particularly after typhus and typhoid fevers, but occurs also in *progressive muscular atrophy*. Indeed, in this peculiar malady, all the three kinds of degeneration—the *granular*, the *fatty*, and the *vitreous*—may be seen, not only in the same patient, but in the same muscle.§

In a large majority of instances, *progressive muscular atrophy* first makes its appearance in one of the upper extremities, especially in the right limb. It begins commonly in the muscles of the hand, first in the thenar eminence, then in the hypothenar, and next in the interossei. When the interosseous muscles are considerably wasted, the hand assumes the appearance of a bird's claw—the *main en griffe*, as it has been termed by Duchenne. If the atrophy extends upwards, the flexors and extensors of the fingers, and sometimes the muscles at the back the fore-arm, become involved. When the disease extends beyond these limits, it attacks the muscles of the arms and trunk; the biceps first, then the deltoid and the triceps, the pectorals, the latissimi dorsi, the rhomboidei, the extensors and flexors of the head, the sacro-lumbales, the abdominal muscles, the muscles of respiration and deglutition. Occasionally the depressor muscles of the jaw become involved. In some instances the atrophy is limited to the muscles of the fore-arm, and in others it begins in the muscles about the thorax, and makes considerable progress, while the arms remain unaffected. Sometimes it extends to the lower extremities, but rarely begins there.

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* *Edinb. Med. and Surg. Journal*, April 1849.

† *Ueber die Veränderungen der willkürlichen Muskeln in Typhus abdominalis.* Leipzig, 4to. 1864.

‡ Cornil et Ranvier, *Histologie pathologique.*

§ Charcot et Joffroy, *Archives de Physiologie normale et pathologique*, [illegible] No. 3, p. 363.

The unequal and irregular wasting of the muscles produces in the trunk and limbs a variety of alterations in their shape and position, which are characteristic of the disease; for in ordinary atrophy succeeding exhausting diseases, the emaciation is uniform, as it affects nearly all the muscles of the part to the same extent.

The earliest symptom of progressive muscular atrophy is a loss of muscular power in the afflicted parts, especially after exercise or exposure to cold. With this weakness there is an awkwardness in the patient's movements, and a certain loss of muscular co-ordination, arising from the unequal or irregular wasting of the muscles, and the consequent change in their relative force or antagonism when employed in the performance of voluntary movements. Among the other early symptoms are cramps, twitches, and fibrillary tremors in the muscles. Generally the sensibility remains unimpaired, but occasionally there is numbness of the skin, or a certain degree of cutaneous anæsthesia; while, on the other hand, in about half the cases, more or less pain is experienced in the wasting muscles, or previous to their atrophy.

Pathology.—Cruveilhier, who was the first to investigate the morbid anatomy of progressive muscular atrophy, believed that atrophy of the motor nerves was the starting-point of the disease. This opinion was founded on eleven cases in which the motor nerve-roots were more or less wasted. But in the majority of instances in which post-mortem examinations were made, no appreciable alteration of the nerve-roots was discovered. It was therefore inferred that atrophy of the nerves cannot be the actual cause of that state of the muscles; and since no disease of the nervous centres had hitherto been

muscular atrophy, numerous lesions
consisting chiefly of areas of what I
disintegration.* In several other case
examined, the same kind of lesions wer
with similar alterations of some of t
dilatation of blood-vessels, or atrophy
of the anterior roots of the nerves.† Si
on this subject, several German and I
means of improved methods of obse
similar results.‡

Etiology.—Among the predisposing
muscular atrophy, consanguinity, or
universally acknowledged to hold the fi
collected the history of ten families in
prevailed, and of these, twenty-nine ind
Aran relates that a sea-captain had lo
and a sister by this disease, and that
aunts had died from the same malady
were four boys who had six healthy
family two boys were affected, while t
The male sex is therefore much more pr
than the female—in the proportion of
nearly all the hereditary cases on reco
generalized, and therefore tended to a f

Among the chief exciting causes a

ble to the influence of cold and wet, the atrophy is r preceded and accompanied by neuralgia or so-called ic pains in the affected muscles, or in the course of the ading to them. Syphilis, again, appears to be one of the le causes of the disease. To this form M. Rodet has e name of *atrophie musculaire progressive syphilitique.*[*] instances no particular cause can be clearly assigned, e are the cases in which hereditary influence appears to o operation.

ent.—This must of course depend, to a certain extent, auses to which the disorder may be reasonably traced. from the influence of cold and damp, or avoidance of ıscular exertion, is of primary importance. Warm and baths, especially those of Aix-la-Chapelle, have been rly recommended. When there appears good ground ing that the atrophy is attributable to syphilitic taint, potassium, or perhaps mercury, must be employed. In ributable to other causes, vegetable and mineral tonics, oil, and phosphorus may be administered. Dr. peaks very highly of the long-continued use of arsenic. all remedies hitherto employed, galvanism is unr the most useful, when applied to the affected muscles. efit derived from it, however, is very often temporary. trongly recommends the application of the constant current to the spinal column, particularly in the region. The fact, as already stated, that in the stages of progressive muscular atrophy, various ave been found in the spinal cord, would suggest the of trying the effects of counter-irritants, particuns and blisters to the spine, in the early stages of the

are two other special forms of muscular atrophy, which iar to the period of childhood, viz., the atrophy which nfantile paralysis, and the degeneration of muscles arent hypertrophy.

muscular atrophy of infantile paralysis is extremely ıg to the surgeon, in consequence of the deformities so frequently occasions. The period of childhood at is disease makes its appearance varies from a few months to a few years after birth, more especially during the first dentition. The attack is generally sudden, and frequently preceded by a feverish state which may last a few hours or a few days, accompanied occasionally by convulsions, which are immediately followed by paralysis without loss of sensibility. The paralysis generally begins in the lower extremities, but rarely attacks the upper extremities alone. At first it is more or less general, but after a variable period it restricts itself to particular muscles, or groups of muscles, or to a particular member, and thus becomes localized. The muscles upon which it most frequently fixes are those at the anterior part of the leg—the extensors of the toes, and flexors of the foot; the extensors and supinators of the hand; the extensors of the leg, and muscles of the foot. Sometimes single muscles are affected, and most commonly, the extensor longus digitorum of the foot, the tibialis anticus, the deltoid, or the sterno-mastoid. After a time, varying generally from one to two months, but sometimes much longer, the paralysed muscles begin to waste, and may ultimately be reduced to mere fibrous bands. Nor is the atrophy confined to the muscles; it involves the bones, ligaments, and other parts.*

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[*] *L'Union médicale*, No. 26, p. 403, 1859.

The paralysis and the atrophies by which it is succeeded combine to produce a variety of deformities and unnatural attitudes which call for the surgeon's skill, either in the application of mechanical apparatus, or in the performance of necessary operations. These deformities consist chiefly of *talipes equinus*, *equino-varus*, *equino-valgus*, *calcaneus*, or *calcaneo-valgus* and *talipes varus*.†

The paralysis itself and the muscular atrophy to which it gives rise are not often fatal. The difficulty consists in restoring the muscles to their normal condition; but this, in many instances, may be accomplished. The remedies recommended by the most experienced practitioners consist of nux vomica, strychnine, cod-liver oil, the preparations of bark and iron; sulphur and salt-water baths; blisters and counter-irritants along the spine; stimulating embrocations to the affected muscles, and especially the application of electricity.

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* Laborde relates a case in which considerable atrophy of the deltoid muscle occurred in four *days* after the first appearance of the paralysis. *De la Paralysie (dite essentielle) de l'enfance*, p. 45.

† For the description and treatment of these deformities, see the following article, ORTHOPÆDIC SURGERY.

2. *Degeneration of muscles with apparent hypertrophy.*—This peculiar disease was first understood and diagnosed by Dr. Duchenne (of Boulogne) in 1858. Since then it has been recognised and investigated chiefly in Germany by Griesinger, Eulenburg, Cohnheim, Berind, Wernich, Oppolzer, Heller, and Seidel. It begins in childhood, like the malady just described, but often continues up to an advanced period of youth, when the patient is cut off by some intercurrent disease. Its course may be divided into three stages: a stage of partial and incomplete paralysis; a stage of apparent muscular hypertrophy; and a stage in which the paralysis becomes general, and the muscles waste.

The first stage begins with weakness of the lower extremities either before or after the period at which the child should be able to walk. In the former case, when the little patient attains the age of ten or twelve months, and attempts to walk or stand, it falls immediately, and continues unable to walk, even when assisted, for two or three years.

The second stage begins some months—or even as long as two years—after the muscular weakness, and is manifested by a progressive enlargement of the gastrocnemii, then of the glutei and lumbar muscles. This enlargement occurs sometimes in nearly all the muscles, but in general it is limited to a few. The enlarged muscles are firm and elastic, and become very hard during contraction. This condition may remain stationary for some years.

In the third stage the paralysis gradually increases and becomes more general. The patient is no longer able to stand upright; the upper extremities become affected; the enlarged muscles rapidly decrease in volume; and the limbs and trunk become atrophied *en masse.* In this state the patient may exist for a considerable time, but ultimately dies by intercurrent disease. Many of the children afflicted with this singular disorder have dull intellects, and are occasionally more or less idiotic.

Morbid anatomy.—The morbid anatomy of this disease has been investigated chiefly by Duchenne, in France, and by Eulenburg, Cohnheim, Griesinger, and others in Germany. Nothing abnormal could be discovered in either the nervous or vascular systems. Eulenburg and Cohnheim found the electro-muscular contractibility everywhere perfect. To the touch the muscles gave the sensation of a doughy and inelastic mass.

They were marked with stripes o
appearance. At certain points t
by the naked eye from the subcu
was also great hypertrophy of con
cular fibres, which were frequent
although they were not otherw
and Ordoñez found the striæ on t
usual, and semitransparent. T
with an increase of connective t
fat-cells, were also observed in o

Treatment.—During its first s
curable. Duchenne has record
the second stage scarcely any ho
tained. The treatment consists
and shampooing.

Ossification of muscle.—The c
truly a degeneration, as it is a c
structure into an amorphous m
may be said of the so-called bo
which are not true bone eithe
chemical composition; while the
sesses all the qualities of true bo
ment of one organic structure
term 'degeneration' would ill
clinical lecture to which I shall
that the ossific deposit in mus
cancelli, compact shell, perioste
also under the microscope all
Quekett showed Mr. Tatum som

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* Dr. Duchenne has invented an ing
'emporte-pièce histologique,' for removi
living subject. It is made by Charriè
cylindrical rod, divisible longitudinally i
a handle by means of a screw, and ter
hollow cone, the base or lower border
When closed, the two pieces together fo
point. As soon as it is made in this stat
cone is opened by sliding down the other
portion of the muscle, which it cuts a
withdrawn.

† *De la Paralysie musculaire pseudo-hy*
gén. de Méd. Janvier et seq. 1868.

tions, which prove the true bony nature of these deposits. ific growths may take place over a large extent of the ntary muscles, or may be limited to one or two points. the Museum of the College of Surgeons is the skeleton of a n in whom nearly all the muscles of the back had become fied, large sheets and masses of bone occupying the places the latissimus dorsi, spinalis, and rhomboid muscles, forming ge bony sheets on the back and sides, while large stalactical owths of bone spring from the pelvis, ribs, and scapulæ. e following case is valuable from the circumstance of its ogress having been watched from its commencement up to its y advanced state in 1862, when the account was published.

G. Brown, aged twenty-two, was originally admitted into St. George's pital under the care of Mr. Cæsar Hawkins in August, 1843,[*] with swellings the dorsal and lumbar regions, some of them apparently bony. Their appear- ce was accompanied with severe rheumatic pains. All these disappeared under atment. They reappeared, however, and then one was removed from between e trapezius and rhomboid muscles; it was intimately connected to both, fibres m both being inserted into it; one end of it was fixed to the spines of the th and seventh dorsal vertebræ, the other was smooth, playing on the end of e scapula. After this, for four years, fresh tumours were observed to form in fferent muscles of the trunk and neck, being at first soft, growing rapidly, then becoming hard, and, after a time, either disappearing altogether under treatment, or leaving a bony deposit behind. This new bone extended slowly towards either extremity of the muscle in ridges corresponding to its fibres. He was now lost sight of, but in June 1859 again presented himself at St. George's Hospital, with extensive ossification of the muscles, together with several exostoses both on the spine and ribs. The greater part of the latissimus dorsi on either side, especially at the free edges, was ossified; large masses of bone filled up the hollows on either side of the vertebral spines from the sacrum to the occiput, soldering all the bones together into an inflexible column. The ribs were likewise immovable, partly from being anchylosed to the spine, and partly by the ossification of the muscles connecting them with the scapula and spine; so that respiration was entirely performed by the diaphragm. The trapezius, and, apparently, the deep muscles at the side of the neck, contained large deposits of bone; both scapulæ were immovably fixed to the ribs, principally by the ossification of the serratus magnus and rhomboid muscles. In front, both the great pectoral muscles, from their origins to their insertions, were almost entirely ossified, presenting ridges taking the course of the fibres, and forming large masses at the folds of the axilla. The sterno-hyoid and sterno-thyroid muscles were much ossified; and these, together with the recent appearance of a considerable swelling below the chin, had been accompanied with so much difficulty in deglutition as to alarm him; he therefore came to the hospital to see Mr. Cæsar Hawkins, under whose care he had before been. The fulness in the upper part of the throat was not hard, but very tender; it yielded to a second application of a blister in a few weeks, so that the genio- and mylo-hyoid muscles could be

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[*] *Med. Gaz.* vol. xxxiv. 1844, p. 273.

distinctly felt almost entirely ossified. Preparations from this c
Museum of St. George's Hospital.

The cause of osseous growth in muscles is no
plained. A tendency to increased bony deposit is r
common, and shows itself in exostosis and extens
growth into the tendons inserted into the bones; b
growth in muscle it is a distinct formation, and
at first, connected with exostosis. It is of inflamma
as the pain and swelling, and also the effects o
would indicate. Mr. Abernethy mentions the cas
in whom either an exostosis or bony growth in a
variably followed a blow on the part. Mr. Hawk
to an account of eighteen cases of bony growths
among the recruits in the Prussian service; these v
have been the result of inflammation in the delto
toral muscles. Inflammation of muscle is rare,
of bony deposit in the system is not very commor
they both occur in the same individual, the exudati
the former would seem to be a favourable nidus for os
As regards the treatment, no local measures answ
above case so well as blisters, under which, with the e
colchicum internally, considerable diminution of t
and relief of the pain took place. The swellings cor
appeared after a course of the iodide of potassium,
and then seven, grains thrice a day in sarsaparilla
returned again shortly after, while the patient was
the medicine. On the reappearance of the disease, r
given, two grains of calomel and a quarter of a gra
twice daily, which at the end of three weeks pr
mouth; again, all the swellings were nearly remov
rapidly, then slowly; but a large mass of bone between
and spine was removed, as stated, by operation. Afte
hæmorrhage and other causes, his health failed, and h
reduced, and specifics were laid aside for some time.
fresh tumours, having, however, formed, he, in a f
began the phosphoric acid, first in half-drachm, and
in drachm, doses, three times daily, which he cont
April 6 to May 21. The swellings greatly dimini
this treatment, and with the repeated application
their recurrence seems to have been arrested. Thus

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* *Surg. Lect.* vol. iii. p. 169.

appear to have been chosen with a view to the inflam-ory nature of the complaint, and to have been most acious; yet so strong was the tendency to relapse, that the llings formed again and again, even under the treatment had caused them to disappear. They were, however, ly arrested, the blisters having been most conducive to end.

TUMOURS IN MUSCLES.

umours of different kinds are occasionally found in muscle. haps that which occurs most frequently is the fibrous our, of a cartilaginous hardness, and often growing to a iderable size.

lad, aged fourteen, was under Mr. Tatum's care in St. George's Hospital in ummer of 1860, with a tumour as large as the double fist, at the back part e left thigh, about its middle; it was extremely hard, and appeared to be a roid tumour growing from the bone, so closely did it seem to be attached ; on relaxing the muscles, however, by bending the knee, it admitted of a in movement on the femur. The tumour was removed, but not without ulty, partly from its vicinity to the bone, which it seemed to grasp, and y that the great sciatic nerve was imbedded in it, and was only freed by care-l dissection. The tumour was found to have had its origin in the semimem-nosus muscle, the lower part of which was healthy, but the part above the mour was converted into a pale structure similar to the tumour, but less se, and retaining the form of the muscle, with a slight remnant of fibrous pearance. The tumour was extremely dense, of a semitransparent, cartilagi-s aspect. Some of the fibres of the muscle were spread over the tumour; ers dipped into it, but were soon lost in its substance.

Shortly after this, a tumour of a similar character was removed from the toid muscle of a young man by Mr. Johnson; it was about the size of an egg, l surrounded on all sides by muscular fibres. Many of the fibres entered, l could be traced a considerable way into the dense fibro-cartilaginous ss.*

The recurring fibroid, although it does not originate in mus-lar structure, has a great tendency to be reproduced in it.

In two patients under the care of Mr. Hawkins in St. George's Hospital, ch of whom had a tumour of this description in the breast, and in whom e tumours returned, and were removed several times, it was observed that when the recurrence took place the pectoralis major was the part principally involved. A man came under Mr. Tatum's care, from whom a tumour of the above nature had been removed from the parotid region, and subsequently a recurring small one from over the masseter muscle; four months after which he became Mr. Tatum's patient, having a tumour about the size of a French walnut in the neighbourhood of the second cicatrix. On removing it, Mr. Tatum found that it had formed in the upper part of the masseter muscle, a few fibres of which only remained. A few months after this, he again came under Mr. Tatum's care, with two tumours the size of filberts a little above the site of the last, and which proved, on dissecting them out, to have had their seat in the temporal muscle. Mr. Tatum had a lady under his care from whose breast he twice removed a tumour of the above nature; the disease returned in the pectoral muscle, in which it made rapid progress. The event of this case is not recorded.

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* Mr. Curling gives an account of a fibrous tumour which he removed from e gastrocnemius muscle of a girl aged nine; its circumference was not very arly defined from the muscle, so that its more prominent central part only s removed. See *Path. Trans.* vol. vi. p. 346. Mr. Birkett removed a tumour om the short head of the biceps flexor cruris, of a chondro-ostoid growth, 4½ r 3 inches in size, of a greyish-pearl tint, and of cartilaginous structure; the ntre was of bone. Ibid. vol. ix. p. 397.

Cysts of various kinds are occasionally found in muscles. Some of these cysts contain hydatids. Such is the *trichina spiralis*, a bisexual and minute nematode worm which is reproduced viviparously by the female parent. The female trichina is about one-third longer than the male, and in the mature state contains in its uterus a variable number of ova, as well as free embryos in different stages of development. When the flesh of an animal containing spiral trichinæ is eaten by another, the contents of the small intestines are found, after about twenty-four hours, to contain a multitude of these worms, which lie imbedded in the mucus or in the chyme. Soon after the embryos are born, they begin to migrate from the intestines in search of muscular tissue, upon which they feed and develop. Concerning the manner in which migration is effected, there is some difference of opinion. Most observers believe that the young trichinæ pierce the walls of the intestines and other parts until they reach the muscles; while other observers, with Dr. Thudichum, contend that, after penetrating the mucous membrane of the intestines, they enter the blood-vessels and lymphatics, pierce the lymphatic glands, reach the heart with the venous blood, traverse the lungs, and are then distributed by the arterial circulation, to all parts of the body. However having reached the muscles, there they feed, and grow, and ultimately become encapsuled. Leuckart maintains that the young trichina always penetrates the sarcolemma, while other observers assert that it lives and grows either inside or outside that sheath. However this may be, so long as the worm remains outside, the muscular fibre is not permanently damaged, although it becomes somewhat granular, and loses the distinctness of its transverse striation. But if the parasite pierces the sarcolemma, the fibre is permanently destroyed; the sarcous elements are disarranged, broken up, and transformed into granular masses, which constitute the food of the invader. As the trichina reaches its full growth and becomes fixed to one spot, the interstitial connective tissue and the sarcolemma around it, being irritated and inflamed, throw out an exudation, while the nuclei of both enlarge, divide, and rapidly multiply. The exudation, which appears to consist of fluid fibrine, soon after solidifies and forms a capsule in which the worm coils itself up. At the end of some weeks after infection, fine dark granules of carbonate of lime and magnesia are deposited in variable numbers within the capsule, and render it more or less opaque.

In man, trichiniasis is produced by the ingestion of imperfectly-cooked flesh of animals infested with trichinæ—particularly pigs.

The pathognomonic symptoms of trichiniasis are the following:—

Sudden swelling of the face, particularly the eyelids, after the patient has for some days felt prostrate and lost his appetite; fever, with quick pulse and copious perspirations, which have sometimes an offensive odour; painfulness and immobility of arms and legs; the muscles are swollen and contracted, and give great pain when set in motion or touched; the limbs are semiflexed; gastro-intestinal catarrh, with red and somewhat dry tongue; when the swelling of the face has subsided, the feet, legs, and thighs become œdematous, and soon after anasarca over the trunk ensues. There is no other disease in which this particular combination of symptoms occurs.*

Cysts containing a black tenacious matter are occasionally found in muscles; they probably are of the nature of hæmatoma occurring in other parts of the body, being merely unabsorbed extravasated blood, which has become darkened and inspissated by time. Warren describes a singular tumour somewhat of this nature. A tumour about the size of an egg was removed from the substance of the rectus femoris muscle of a woman; it was said to be of only five or six months' growth; it consisted of a hard dark-coloured muscular substance, in the centre of which was a bony shell an inch in diameter, containing a dark-coloured fluid, which had deposited a black crust on the bony cysts.

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* For a recent and elaborate description of the nature and treatment of trichiniasis, see a paper by Dr. Thudichum in the *Seventh Report of the Medical Officer of the Privy Council*, 1864. Also a shorter paper by Dr. Althaus, in the *Medical Times and Gazette*, 1864.

Vascular tumours are not very frequently found in the substance of muscles. According to Mr. Campbell De Morgan,[*] they occur under three forms. 1. As tumours having the appearance of a varicose state of the veins, unconnected with the muscular tissue in which they lie, but yet not isolated by any well-defined covering of connective tissue. 2. As erectile tissue, forming in, and encroaching on, the muscular fibres, from which it is not separated by any defined boundary. 3. As erectile tissue, forming a defined tumour, having an investment of connective tissue not continuous with the muscular substance in which it is embedded.

The disease is most frequently congenital, but may come on later in life, after injury, or without any assignable cause. It is more commonly seated in the muscles of the lower extremities. The origin, mode of growth, and true structure have not yet been satisfactorily ascertained; but it either spreads through the muscular tissue or occurs in the form of isolated tumours. The muscular fibres on which it encroaches are compressed by the hypertrophied vascular and connective tissues, and their nutrition being impaired by the altered and thickened state of the capillaries, they degenerate to a greater or less extent, and become transformed for the most part into fat, while the connective tissue increases in quantity, and is in some places condensed into masses or bands, which, when they form at the circumference of the tumour, constitute its fibrous sheath. There appears, also, to be an increase in the quantity of yellow elastic tissue. The changes which occur in the vascular tissue itself are not well understood.

Sometimes the disease shows itself in a number of different places in the same subject, as in cases recorded by Cruveilhier; in one of these the hand and arm were covered with innumerable small tumours, varying in size from that of a small shot to that of a large bean. They were all composed of erectile tissue. It is generally allowed that vascular tumours are very prone to degenerate into cancer.

Scirrhus seldom originates in muscles, except in the tongue and substance of the lip. Warren describes a case of what he terms scirrhus of the muscle, which resembles more the account of the syphilitic tumour described as having been removed the shoulder by Mr. South. Muscles readily become ated in the disease occurring in neighbouring parts, and not unusual to find the muscles for a considerable dis- around a scirrhous breast dotted with scirrhous tubercles. osis must be very rare in muscles. Warren mentions a ccurring in the muscular structure between the base of apula and the spine; this had been removed, but a second ur appeared in its place under the cicatrix; it was found, erating on it, to be seated in the substance of the rhom- and trapezius muscles; it was hard in structure, and the ior composed of black matter; six months after this, the se reappeared, of a carcinomatous appearance, and proved

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[*] *British and Foreign Medico-Chirurgical Review*, 1864, p. 187.

cephaloid tumours no doubt originate in muscles, though grow so rapidly, and involve every structure so indis- nately, as makes it difficult, except in certain organs, to e their origin. Warren, speaking of this disease in les, describes three cases. These, however, are not clearly d to have sprung from muscle, except the last, which had at in the lumbar muscles.

AFFECTIONS OF TENDONS.

juries of tendons.—It has been already observed that ten- are ruptured by the action of their muscles more readily the muscles themselves; they may also be ruptured irect force, as in dislocation, and they are often divided ally or entirely in wounds, and by subcutaneous sections. n a tendon is ruptured, or, what is nearly the same thing, led by subcutaneous operation, the part which is attached e muscle is drawn away from the opposite end for about an ; this latter is but slightly retracted by the action of its gonists. Blood is poured out between the ends, but much than in rupture of muscles. The pain is said to be not great; a considerable shock, however, is felt, as from a received on the part, accompanied by cramp of the muscle, a perfect inability to use the limb; and in rupture of the o Achillis a feeling is described as if the heel were sinking a hole in the floor. The tendons most frequently ruptured he tendo Achillis, and the tendons of the rectus femoris the triceps humeri. If the separation of the ends be not

bore a weight of fifty-six pounds. Th
briefly this, according to Mr. Paget (lo
forty-eight hours inflammatory matter is
trates the tissues between the ends; a
infiltration of a material of the characte
blood in a solid state, in which are en
remains of the clot of extravasated bloo
the divided tendon; this by degrees assu
form; but even in five or six days it sh
ture, tending to the production of ten
tenth day, the material becomes paler
assumes a distinctly filamentary form;
weeks there is a perfect cord, of the n
Paget further remarks, that in the furth
the ends of the tendon swell and soften t
effused matter, so that they merge one
ing thereby a closer adhesion. He a
repair of the tendon does not depend on
sheath, as has been supposed. Should
the two ends of a divided tendon be
bond of union will be established betwee
become attached to the neighbouring
partial or entire loss of the use of tl
Where the integuments and surroundin
a division of a tendon, there is, as in

annot be hoped for, but still a perfect union with recovery action of the muscle usually takes place. The severed ire brought closer and closer towards one another by the iction of the new material as it becomes perfected, and maining deficiency is fully compensated for by the accom- ting nature of the muscle. If the tendon of the triceps n, all that is required is a bandage from above downward, a splint in front of the arm to keep it extended: and as nion of tendon is rapid, passive motion may be employed

In rupture of the tendon of the quadriceps extensor i, the same treatment nearly may be adopted as for a ired patella. Where the tendo Achillis is torn across, the nent consists in keeping the foot extended on the leg, and g bent on the thigh; a position favourable to the relaxa- of the gastrocnemii muscles. For this purpose a belt is l round the thigh a little above the knee, the back of i is attached to the heel of a slipper by means of a belt or Before applying the instrument, the calf of the leg should indaged from above downward, care being taken not to ach too near the seat of rupture, for a great displacement ermanent defect would result from the ends of the tendon pressed towards the bones of the leg; somewhat of a ir inconvenience may occur from a too considerable or a ong-continued tilting up the heel. Desault, to avoid the icement of the tendon by his bandage, which, like Petit's, ded over the whole limb, recommends compresses at the of the tendon. John Hunter, who himself had a rupture e tendo Achillis, recommends that, as so little inconvenience ds a small separation of the tendon, compared to the great ivenience and difficulties attending the treatment by ban- s and straps, the parts should be allowed to remain in their al position. He is, however, disposed to adopt a medium een the two, and suggests that the heel should be elevated ig walking, by raising the heel of the shoe; that a bandage ld be kept steadily applied to the calf of the leg, to guard ist involuntary actions of the muscles; and that at night sual slipper and strap might be applied. When the inte- nts and surrounding parts are included in the division of don, the edges of the wound may be brought together by ive plaster, or perhaps by sutures. The mode of bringing ivided ends of the tendon together by means of sutures can ely be recommended, as they produce irritation, and keep the wound open. Bandages are not well borne; rest, therefore, with position, must mostly be trusted to for the cure.

Inflammation of tendons.—Tendons, together with their sheaths, both fibrous and synovial, are not unfrequently inflamed. Independently of gout and rheumatism, the most frequent cause is a sprain or wrench in the neighbourhood of a joint. These injuries are occasionally productive of long-continued wearing pains, assuming much of a rheumatic character, and yield, often slowly and unwillingly, to the remedies, both local and general, employed in rheumatism. Sometimes these sprains are followed by inflammation, with great effusion into the sheath and surrounding cellular tissue (especially in the region of the foot and ankle), which, either rapidly in an acute form, or slowly in a chronic form, may extend to the ligaments and periosteum, destroying the joints, and producing caries of the bone.

Under the name of 'ténosynite crépitante,' the French describe a slight degree of inflammation of the sheaths and investments of the muscles and tendons: it follows long-continued and fatiguing muscular exertion, and for the most part occurs in the muscles of the fore-arm. I have observed it mostly in the extensor muscles of the thumb as they pass over the radius: it is usually accompanied by considerable pains extending up and down the limb, and a well marked crepitating or creaking feeling can be felt by grasping the part while the muscles are in action. The treatment consists in complete rest, and stimulating or even vesicating applications. In one of the forms of whitlow, *paronychia tendinosa* of Abernethy,* the tendons and their sheaths in the finger and hand are the seat of a severe and often most destructive inflammation, which, though often confined to one finger, not unfrequently extends to the hand and arm, attacking not only the tendons and softer parts, but exposing the bones and disorganising the joints. It arises from the same causes as the other forms of paronychia, slight wounds, pricks, with or without inoculation of irritating or poisonous matter, and often without any evident cause, though doubtless depending much on the state of the general health. It begins with severe and throbbing pain on the palmar face of a finger, which extends along the arm, often to the shoulder: the apanied by redness and swelling, with great hardness and on: if not checked, the inflammation proceeds quickly g the front of the finger, and is soon followed by suppuration e sheath; this at first is in small quantity, and, in conse- ce of the great hardness and swelling of the part, cannot tected by the touch; if no relief be afforded, the suppura- quickly proceeds along the sheath, the inflammation and are aggravated by the density and unyielding nature of the h, and are accompanied by much constitutional disturbance; sses burst externally from time to time as the disease nds along the sheath, from which fungous granulations g, the tendon in a sloughy state lying at the bottom. With er treatment, and in a favourable state of the general health, progress may be arrested with a greater or less amount of ruction of the parts attacked, and a proportionate deformity. ertain unhealthy states of the system, however, in which diffuse or erysipelatous form of inflammation prevails, the mmation and suppuration extend into the palm of the hand nd the palmar fascia, and to the rest of the fingers. The le hand now presents a highly inflamed appearance, of an pelatous nature, with great swelling and tension; nor does mischief end here, but, passing under the transverse liga- of the wrist, ascends into the fore-arm, forming large se abscesses amongst its tendons and muscles; and in the t cases not only the joints of the finger, but those of the ls and wrist are destroyed, and the bones denuded and sed. The health during this time suffers severely from tive fever, with gradual prostration of the bodily powers.

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* Lect. xxviii. *Lancet*, April 29, 1825.

eatment.—In the very early stage the inflammation may be arrested by leeches, followed by hot fomentations to n and relax the hard and unyielding tissues. The hand ld be elevated, and an active purgative, with other anti- gistic measures, prescribed; if relief do not soon follow, but, he contrary, the continuance of pain and throbbing with ased hardness indicate the extension of the inflammation, t the formation of pus, no further time must be lost; a free on must be made along the centre of the finger, and gh there may be but very little or no pus in the sheath, yet the on of the tensely strangulated structure, and the escape od and serum, afford the greatest relief. By these means ischief may be arrested, and the finger perfectly restored. he other hand, the inflammation may proceed along the sheath in spite of the most ready treatment; suppuration may have extended under the palmar fascia; further incisions must then be made; and it will now be found proper to support the powers of the system by a generous diet, stimuli, and tonics. In these cases the tendon will slough, and one or more of the joints will be anchylosed, with such disfiguration as may at a future time require amputation; for a stiff and distorted finger, in almost any condition of life, is very inconvenient as well as unsightly. In the more chronic states, where, notwithstanding free openings having been made in the palm, abscesses burrow about the hand, I have found the best results from pressure with pads of lint soaked in pure liquor plumbi, and a bandage, the powers being supported with tonics, good diet, and stimuli. Where the suppuration extends to the arm, the case is more serious; and if, from the state of the constitution before alluded to, it proceeds to the indiscriminate destruction of the joints, nothing but amputation remains, and even that may not save life.

Mr. Tatum has amputated the fore-arm twice for this disease: the first case was in a gardener, a patient at St. George's Hospital. He seemed healthy and strong, but the diffuse suppuration extended rapidly along the sheaths to the hand and arm, destroying the joints of the hand and wrist, in spite of every endeavour to arrest the disease; and though amputation was performed before the powers were very much prostrated, it was only by constant attention and active treatment that after a long time the man recovered. The other case was that of a gentleman, aged fifty-five, whom Mr. Tatum attended with the late Mr. B. Cooper and Mr. H. Phillips: he was of a bad habit of body, pale and flabby, with a weak pulse; the suppuration, beginning in the little finger, spread with surprising rapidity along the sheath, quickly involved the other fingers, then the hand and fore-arm, destroying the joints in its course, in spite of free incisions and whatever could be devised in the way of support. Nothing produced the slightest check to the progress of the inflammation, nor any reaction of the system; it was therefore agreed that the arm should be amputated. Mr. Tatum performed the operation unusually high up in the fore-arm, with a view to cut through sound parts; but even at this height the knife passed through the extremity of an abscess. No reaction took place after the operation; the stump soon assumed a flabby, half-sloughy state; and after some days the patient sank.

It has been already remarked that tendons, as well as muscles, are the seat of syphilitic enlargements. In one of the cases recorded by Mr. Tatum, the tendinous origin of the sterno-cleido-mastoideus was much thickened. M. Bouisson (loc. cit.), describing these swellings, remarks that they are formed by deposit between the fibres, as in muscles. He also relates a case of strabismus from a syphilitic tumour occurring tendon of one of the muscles of the eye. M. Lisfranc[*] s of certain node-like swellings on the surfaces of ten- which he calls 'nodosités blanches des tendons.' Syphi- nlargements of tendons do not, as in muscles, readily to the internal use of the iodide of potassium; they e an active local treatment as well, such as iodide and rial ointment, or blisters kept open with mercurial oint- Swellings of the tendo Achillis occasionally occur ut a syphilitic origin. Mr. Tatum has found them in ns who have taken long and fatiguing walks, not having accustomed to much exertion. These swellings some- occur as a simple rounded enlargement in the tendon, sometimes as an irregular thickening; they are tender handled, and are sufficiently painful in walking to make tient limp. These tumours are often troublesome to cure, y do not readily get well without rest, and the pain and venience are not usually sufficient to induce the patient to ; in order, however, to cure them, it will generally be found sary for the patient to lie up, or at all events to avoid the part, and to apply the local means recommended in litic tumours, as blisters kept open with mercurial oint- or the emplastrum ammoniaci cum hydrargyro, &c.

nours of tendons.—Malignant tumours do not often spring tendon; it offers, on the contrary, like other fibrous tures, a lengthened resistance to their progress. Warren the following account of a malignant tumour growing in ubstance of tendon. A round and prominent tumour red above the patella three inches in extent, without pain or sensibility, but causing lameness; it had been ng six months. On cutting down, the fibres of the rectus n, which were stretched over the tumour, were separated, ing a white fungous growth firmer than the ordinary us tumour, but breaking in pieces when handled. On al, it was found to be mixed up with fasciculi of tendinous . It showed no disposition to bleed. This tumour re- d after the healing of the wound, and was again removed, it presented a more decidedly fungoid character, with fewer ious fibres. The case terminated fatally, with the formation nours within the abdomen. Fibrous tumours occasionally in tendinous structure, as in fasciæ, and other parts of a fibrous nature. Small cartilaginous enlargements are often found in the course of tendons, especially those of the hand and foot; they do not grow to a large size, and seldom produce any inconvenience. Small growths, described as tæniophytes by Albers,* are sometimes found growing on the surface of tendons near their junction with their muscles; they vary in size from a pin's head to a cherry; they are at first altogether cartilaginous, but as they increase in size calcareous matter is deposited in them, as in the development of bone.

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[*] *Gazette des Hôpitaux*, No. 1842.

AFFECTIONS OF BURSÆ MUCOSÆ.

The closed synovial bags called bursæ mucosæ are of two kinds; those situated in the subcutaneous cellular tissue, and those connected with tendons. The subcutaneous bursa is formed of cellular membrane that has been exposed to friction and pressure, by which its cells are obliterated and a single cavity formed; it retains, in part, the form of its cellular origin, for even after great distension the interior often presents a sacculated or multilocular appearance. Like cellular membrane it has much of the character of serous membrane, in its ordinary state exhaling a fluid little denser than serum, but assuming, after a time, much of the nature of synovia. The subcutaneous bursæ are numerous,† and are either normal or adventitious. The normal occur mostly between the skin and some bony prominence. The adventitious bursæ are formed below corns, bunions, or other accidental callosities, as those arising in talipes on the sides or back of the feet. These sacs are liable to become enlarged from various causes, mostly local, as pressure, friction, or blows, though occasionally constitutional. The bursa in front of the patella is most frequently the seat of enlargement, forming a tumour familiarly known as *the housemaid's knee*. The contents of these enlarged cysts vary much; at first they are distended with a fluid little more dense than serum, gradually acquiring more and more the nature of synovia; it is often mixed with blood, either recent or in a thick grumous state; sometimes there is a dark-brownish adhesive fluid containing cholesterine; occasionally, after long-continued pressure, fibrinous matter is deposited within the sac, something after the manner of an aneurism, which gradually fills up the cavity, forming a tumour of a

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* Vidal, *Pathol. extern.* vol. ii. p. 763.

† Ibid vol. i. p. 300.

e fibrous structure; sometimes it is solid throughout;
e frequently there is a central cavity containing a gelatinous
l; sometimes the fluid in an enlarged bursa contains nu-
ous bodies, resembling melon-seeds or parboiled rice; these
of a dense, fibrinous nature, and appear to be either the
lt of broken-up deposit, the portions becoming round and
oth by motion and attrition, or productions from the inner
ace of the fibrous deposit, which from the effects of motion
friction become first pedunculated, and then, being detached,
loose into the fluid of the sac, much in the same way as
rs in the formation of loose cartilages in joints. Inflam-
ion, terminating often in suppuration, sometimes takes
e in bursæ mucosæ; we see it occurring in a previously
lthy state of the part, after a severe blow or a wound, espe-
ly in the bursa over the olecranon; the inflammation runs
high, and is not confined to the sac itself, but, in a diffuse
, extends often over the whole arm, with much swelling,
ess, and tension; the pain is great and the constitutional
rbance considerable, and in old people there is sometimes
h danger. Pus forms rapidly, not only in the sac but also
e cellular membrane, if not relieved. Enlarged bursæ of
atella are frequently attacked by inflammation and sup-
tion, and usually there is extensive inflammation of the
unding cellular structure; and sometimes such large col-
ons of pus are found in the neighbourhood of the sac, as
ir B. Brodie to consider that the suppurating bursa occa-
lly gave way, and allowed its contents to escape into the
lar membrane. The readiness with which the neighbour-
ellular membrane is involved in the inflammation of sub-
neous bursæ, is probably due as much to the sameness of
nature as to the continuity of their tissue. Troublesome
burrowing ulcers sometimes remain after these abscesses,
sometimes from undue pressure and neglect of a hardened
These ulcerations are singularly obstinate, sometimes
considerable fungous growths, the skin around being dark
unhealthy, with deep burrowings under the integuments
t the knee, and a foul and offensive discharge.

eatment.—Whatever treatment may be adopted, it should
ccompanied by complete rest. When the bursa over the
lla is affected, a well-fitting ham-splint may be applied,
all motions of the knee-joint prevented. Simple enlarge-
, if recent, will often subside under rest and a slightly

stimulating lotion, such as ammoniæ hydrochlorat.
℥v., aceti ℥j. M. Some merely transfix the burs
needle, and leave it to itself. If the enlargement ha
some duration, with thickening, more decided measur
required. Some surgeons evacuate the contents by
and follow it by pressure with a pad and strapping; t
likely, however, to fill again, and will require repeat
tures. Counter-irritants often effect a cure, such as
plastrum ammoniaci cum hydrargyro, or a blister over
The iodine ointment or the tincture of iodine applie
skin over the tumour, may in some cases succeed, e
where the contents have been previously evacuated. M
recommends a seton, composed of a few threads of
be passed through the cyst; suppuration is thus set
the pus escapes on moving the threads from time t
compression is also employed by means of a pad and a
plaster, the openings being left free. By these means
charge gradually diminishes, and, partly by contracti
partly by granulation, the cavity becomes obliterated
French surgeons often treat these cases with iodine inj
like hydrocele. When there is much solid deposit in t
Mr. Key still finds the treatment by seton the most ef
for, considering that the induration is kept up by the ir
of the cavity, the seton, by producing inflammation and
ration, would cause its obliteration, and the absorbent
remove the indurated walls. When the tumour has
almost or quite a solid, gristly mass, there is no rem
dissecting it out, which can readily be done without
consequences. Where the tumour is very large, and
the patella, care should be taken not to wound the apo
covering of the joint.

In acute inflammation of the bursæ, both local and
antiphlogistic measures are required; but where there i
inflammation around, of an erysipelatous tendency, much
is derived from the sesquichloride of iron lotion,† with
support. If suppuration has taken place in the sac,
either be laid open with a free incision, or a seton
passed through it; the former would be preferable whe
is much surrounding inflammation, as it not only gi
exit to the matter, but diminishes tension, relieves the

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* *Guy's Hosp. Rep.* vol. i. p. 415.

† Tinct. ferri sesquichlor. ʒj., aquæ destillat. ℥viij.

d and the cellular membrane of the effused serum, and
prevents it from running into suppuration. If pus have
y formed in the cellular tissue, it will probably be neces-
o make one or more incisions for its escape, in as depend-
position as possible, and the system will require general
rt and stimuli.*

bursæ of tendons have more the character of synovial
ranes than the subcutaneous bursæ, and are either simple
ontaining a lubricating fluid, placed between tendons and
nences of bones, as that between the ligamentum patellæ
e tubercle of the tibia, or complicated with numerous pro-
and elongations, as in the synovial sheaths of the flexor
ns of the hand and wrist. These, like the subcutaneous
, are liable to enlargement, and often attain a considerable
but, from their deeper situations, they are less exposed
uries from without, and consequently do not so frequently
e and suppurate. The bursa between the ligamentum
æ and tibia sometimes enlarges and forms a tumour,
, by filling up the depression on each side of the ligament,
nts the appearance at first of synovitis of the knee-joint;
he absence of swelling above and around the patella
rs the diagnosis easy. Distension of the bursa above the
usually accompanies synovitis, because this bursa almost
s communicates with the joint; this, however, is not
s the case, and Mr. Tatum has seen a large bursal tumour
the vasti, the joint being quite healthy. One of the
of the hamstring muscles (usually that of the biceps)
ionally enlarges, and appears in the ham as a pulsating
ur, often of considerable size; it is, however, too little
n aneurism to be mistaken for one by a careful observer.
same may be said of the bursa of the subscapularis, and
bursæ about the shoulder-joint, which sometimes form
urs in the axilla, occasionally pulsating from their vicinity
e artery. The bursa between the psoas and iliacus
nus and the capsule of the hip-joint sometimes forms a
ur, which from its situation may be mistaken either for
guinal aneurism or for a psoas abscess; the extrinsic
cter of the pulsation and the absence of all other aneur-
symptoms in the one case, and the want of spinal
oms and of fluctuation above Poupart's ligament in the
assist in forming a right diagnosis. This bursa occa-

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* For bunion see SURGICAL AFFECTIONS OF THE SKIN.

sionally communicates with the synovial membrane of t joint, and when inflammation occurs in the former, the latt will most likely be involved in it, and serious mischief m follow. The bursa between the glutæus maximus and tub ischii, that between the tendon of the glutæus medius and th trochanter, and that between the latissimus dorsi and the angle of the scapula, from their exposure to pressure and other sources of irritation and inflammation, are not only liable to inflame, but even to suppurate. When, from frequently recurring pressure in sitting, the already enlarged ischio-gluteal bursa inflames and suppurates, it increases in size, becomes painful, and renders sitting on the part impossible, and even motion distressing; lying deep under the mass of muscle, its fluctuation is obscure, and the suppuration is usually slow in coming to the surface, and after it is evacuated, it often leaves a sinus obstinate and slow to heal, from its depth and the movements of the muscle. The same may be said in most respects of the bursa over the trochanter. The bursa at the angle of the scapula often acquires a great size, and when it suppurates, much constitutional disturbance is often set up. Too much caution cannot be taken in opening these bursæ, whether in their simply enlarged state or in the suppurating stage, as an alarming and even fatal train of symptoms sometimes follows the operation.*

The palmar bursal tumour is perhaps the most obstinate of any; forming a swelling under the palmar fascia, it extends under the transverse ligament and ascends into the fore-arm, presenting a double tumour, the contracted part corresponding with the transverse ligament. The fingers are more or less drawn into the palm of the hand, and cannot be straightened. The fluctuation is readily felt by alternate pressure above and below, and when, which is often the case, the melon-seed bodies are present, a peculiar creaking or grating sensation is communicated to the touch. These bodies are often extremely numerous. Dupuytren believed them to be hydatids, and described their appearance minutely.† These tumours, after slight attacks of inflammation, often cease to fluctuate, and become filled with solid, unorganised fibrine; and when inflammation, followed by suppuration, comes on, which it usually does from using the hand in this state, large masses of the coagulated substance be squeezed out through the opening made to let out the this has been followed by the gradual subsidence of the ss, and the perfect restoration of the use of the hand. times, however, the case takes an unfavourable course; e erysipelatous inflammation is set up instead of that of a plastic nature, and a fatal result will occasionally ensue.

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* On the diagnosis between diseases of the bursæ and of the joints, see DISEASES OF THE JOINTS.

† *Leçons orales*, ed. 1839, vol. ii. pp. 140 et seq.

atient was admitted under Mr. Tatum's care into St. George's Hospital lisease of this bursa. He was a publican, about fifty years of age, of a flabby appearance, with failing pulse; the bursa, which had suppurated, en opened above and below the wrist, and was discharging large quan- of pus mixed with the rice-like bodies in great numbers; the hand was ously swelled, and the whole arm, extending above the elbow, enlarged, and of a deep-red colour. The case in many respects resembled that of thecitis formerly described, and, like it, proved fatal, in spite of every to support the system that Mr. Tatum could employ.

modification of the bursa is found connected with the sor tendons of the fingers and toes; these are termed lions; their cavities do not appear to communicate with heaths of the tendons, but are formed in the dense tissue ting the sheaths or the capsule of the joint.* They form round, movable tumours, rarely larger than a filbert, ly at the back of the wrist; they are seldom painful, but atient usually complains of a sense of weakness in the . They are found less frequently on the dorsum of the here they present a more compressed form, and are less ble than in the hand. Mr. Tatum has seen them on the part of the dorsum of the foot more than two inches in eter, broad and flattened. These cysts contain almost antly a firm gelatinous substance, nearly as dense as the alline lens of the eye. Ganglia do not, like subcutaneous , arise from pressure; they sometimes follow a sprain, usually appear without evident cause; they are generally n their growth, but now and then appear quite suddenly.

atment of enlarged bursæ of tendons.—These bursæ some- enlarge rapidly, under which circumstance they subside ly by rest and evaporating lotions. The more common hronic form of enlargement requires a more active mode atment. Sometimes a blister alone may be sufficient to their disappearance; this will be more effectual if the has been previously emptied by puncture; and it may be

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* See Boyer, *Trait. des Mal. Chir.* vol. xi.

powers, and condition of the patient be
adopted for curing it; for it must be
measures effect a cure by setting up a
suppuration; and it has been alread
inflammation is to take on a diffuse
form, especially where the bursæ are
tumour is not of long standing, it n
minished, if not cured, by puncturing it
by either compression or blisters. In
Tatum's care with inflamed thecal burs
pital), blisters were kept open for some t
successive punctures the tumours were
felt solid, the cyst containing evidently c
she was now enabled to use the hand an
At the end of a few months, however, t
and inflamed, and fluctuation was perc
below the transverse ligament; an ope
part, and a small quantity of pus esc
ments of coagulated fibrine. Seeing th
the opening and squeezed out a large
straw-coloured coagulum; the cyst bei
was applied, and a generous diet orde
charge took place for some days, but
the wounds healed, and so complete wa

ted in various ways; it is apt, however, to return. If the are not very dense, the sac may be ruptured by firmly pressing it with the two thumbs, or it may be divided subneously with a tenotomy knife, or punctured with a grooved le, and the crystalline contents squeezed out. Whichever is adopted, the swelling will probably return, unless further ans be employed, such as firm compression with a small d body tightly bandaged over the part; or a blister may be plied over the part with a good effect. Boyer (loc. cit.) has cribed a case of very extensive ganglion connected with the ensor tendons of the fingers, which he dissected out and sed to the bottom with lint, having previously failed in the atment by seton and compression. The result of the operan was very favourable. These cysts, however, cannot be irely removed by operation; the attached parts cannot be sected from the tendon or ligament; so that they will urn unless the wound be kept open to the last.

T. TATUM, 1862.
J. LOCKHART CLARKE, 1870.

ORTHOPÆDIC SURGERY.

SINCE the labours of Stromeyer, published in 1831
portant class of affections, denominated contract
deformities, has deservedly much engaged the attentio
surgeon. Scarpa in 1803, Jörg, 1806, Rudolphi, 1823,
1825, Dupuytren, and others, had, without much in
fruit, endeavoured to remove the obscurity in which t
of affections was involved. Their inquiries happily
direct the researches of Stromeyer into a proper d
The term orthopædy has become generally used to sig
treatment of this class of affections.

The pathological nature of the affections relievable
gical orthopædic treatment, often by division of tendo
tomy), is various. They consist mainly of alterations
and movement, of the articulations, especially of those
ing to the lower and upper extremities. These spring

1. From accidental injuries of articulations; undue
and strain; inflammation of joints or contiguous pa
ticularly those succeeded by suppuration and its conse
2. From derangement of the cerebro-spinal system
to paralysis or spasm and contraction.
3. From congenital influences, the varieties of club
example; malformations.

Orthopædic surgery comprehends, therefore, a mul
abnormal forms of the muscular, ligamentous, and
systems, of which some are treated elsewhere in th
On the pathology of deformities arising from diseas
joints, the reader is referred to the essay on those
Rachitic deformities are treated of in the essay on
GERY OF CHILDHOOD; spinal curvatures, in that on DIS
THE JOINTS; strabismus, at p. 249; malformations,
SURGERY OF CHILDHOOD; burn-contractures, under
SURGERY. The affections which we have here to cons

principally those which can be remedied by division of tendons, or mechanical extension, or by both of these means combined.

Before proceeding with the description of the individual contractures relievable by tenotomy, it will be well to consider the circumstances which give rise to contraction and deformity, and to inquire into the condition of the muscles and tendons which renders their division necessary. It is now a well-understood law of pathology, that if any part of the body, into the composition of which muscles enter, be maintained in a state of absolute repose, or be habitually kept in one position, so that the origins and insertions of particular muscles are constantly approximated, whilst the points of origin and insertion of other muscles are consequently proportionately separated, a shortened, contracted condition of the first set of muscles, and an elongated, weakened state of the second set of muscles, are produced. This is illustrated by what occurs during a simple fracture or other injury of an extremity. If the elbow, for example, be for any reason retained a few weeks in the bent position, the muscles on the flexed side of the member become stiff and contracted, and are only gradually restored to their natural mobility by active and passive exercises and use, whilst the stretched-out and weakened extensor muscles recover but slowly their full power of extending the implicated articulation. The state of things just described is aggravated when inflammation, exudation, suppuration, loss of cutaneous or more deeply-situated tissues, and consequent adhesions and cicatrices, interpose pain and physical obstruction to the restoration of complete mobility. The greater duration of the disorder increases the probability that persevering or active remedial means will be required to obviate the shortening of one set of structures and the elongation and weakening of the opposite set. This shortening and contraction occur more rapidly during the earlier years of life.

The influence of paralysis in producing contracture varies according to the nature and extent of the seizure. A single muscle, as the sterno-cleido-mastoideus, the tibialis anticus, or the external rectus of the eye, may be more or less completely paralysed; and the antagonist sterno-mastoid, the gastrocnemius, the peronei, or the adductor oculi, may become contracted. Or several muscles habitually associated in their actions may lose their power of voluntary contraction, as the extensors of the wrist and fingers; and the opposing muscles

contraction ensuing as a consequenc
impairment of the balance of muscu
repose or maintenance of the part in

The induction by abrupt spasm of
or less permanently contracted state
easily intelligible; but the spasm
sistent deformities is not always of t
kind which is illustrated by certai
wry-neck and club-foot, but is usual
sive, as seen in many children's cas
contraction in congenital club-foot a
genital distortions can, we believe, be
naturally excitable or spasmodic c
fibres of the shortened muscles. In
shortened muscle has been set free
excitable retractile disposition of the
again after reunion of the divided
employment of the mechanical or
affected muscle had been kept in an

This contraction of certain muscle
which, for want of any other appro
spasmodic, is therefore very different
retraction which occurs in certain
congenital cases, and in which the
powerless to effect an improved co

ars' duration, induced by cerebro-spinal affection or
flex (?) disorder, the vital abnormal spastic contrac-
o-exists after a time with secondary structural change.
ometimes, however, before structural change has taken
have an opportunity of witnessing that, although the
t walks with the heel, for example, much elevated, yet
he is seated, even with the knee extended, he can volun-
bend the ankle,—contact of the sole with the ground
ng abnormal contraction. Further light is thrown upon
ature of the contraction in congenital club-foot by the
ration that, during sleep, even in very young infants, the
ed foot can be more readily straightened; also that, like
certain cases of adult hemiplegia, when the child yawns
tretches out the limbs, the inversion of the foot often dis-
rs. This observation would show, that whilst in the ordi-
state of the infant's nascent volition the adductor muscles
ibiales) overpower the abductors (the peronei) and invert
member, the act of yawning, with its complicated reflex
ty of inspiratory muscles, and of associated muscles in the
mities, neutralises the peculiar disturbance of muscular
ty on which talipes varus depends.

eems as if in congenital club-foot and analogous distor-
a stimulus or irritant were present in the medulla spinalis,
upon certain ganglionic cells there, which keeps the
ed muscle in a state of tonic contraction, yet not sufficient
tralise the stimulus of the will within the limits of move-
permitted by the structural shortening of the member.
non-congenital spastic contractions appear allied to the
tion which prevails in some states of chorea, in which, when
ill would permit or cause contraction or relaxation of a
ular muscle, an involuntary influence excites contraction,
eres with, and frustrates the voluntary effort. In more
e spasmodic contractions the will is entirely overpowered
structural shortening supervenes to effect the same end.

resume, then :—clinical observation of non-congenital de-
ies, springing from derangement of the nervous system,
s that there are several modes in which they are produced.
modes are as follows :—

Paralytic distortions.

a. Certain muscles only being partially or wholly paralysed, their antagonists slowly contract the dependent articulation.

- *b.* The muscles of the part in general being partially or wholly paralysed, the contractility of the greater mass, as of the flexors in the extremities, slowly contracts the dependent articulation.

2. Spastic distortions.
    - *a.* The contraction is severe and prompt, the will being quite overpowered or absent.
    - *b.* The contraction is gradual, as in the majority of (non-paralytic) cases of non-congenital talipes, the will not being wholly overcome (those reputed from teething, for example), but restricted by the morbid innervation, and in time by structural shortening.
    - *c.* The contraction is gradual but severe, as in the deformities which sometimes accompany imbecility in children. It is probable, in this form, that the contraction is intensified by the co-existence of an enfeebled condition of general volition, a greater inertia favouring repose of members, and a greater amount of structural change.

Secondary changes.—From whichever of the above causes a constantly contracted state of an articulation or limb may have proceeded, the state of things consisting of the inability of the individual to put the part, by the action of the will, through all its proper movements is called a deformity. But if the patient by means of his own hands, or if the surgeon, can overcome the contraction, and put the affected part through its proper movements, no deformity is in reality seen to exist. Positive deformity may early exist, when original disease of the joint has, besides producing contraction, ended in more or less considerable alteration in form and structure of the articulation. almost equally serious (secondary) deformity may ensue through the influence of the now ill-regulated muscles of the joint, especially when these act upon tissues impaired by disease—the production of sub-luxation for example. In the lower extremity, the effects of the weight of the body being borne upon the member in improper directions is a very important cause of secondary deformity, adding greatly to the obstacles to restoration. Thus a not severe case of congenital club-foot, remediable in point of form in a few weeks before walking has commenced, may subsequently require treatment of months or of years; or, from the deteriorating cause above mentioned, be rendered irremediable.

We may now pass to the consideration of the means employed

Orthopædic Surgery for the rectification of deformities. This artment of practice avails itself of much that is common h general medicine and surgery.* Special orthopædic ans are, the relieving of the shortened parts by the employment of mechanical instruments, or mechanical power exerted the hands of the surgeon or assistants, sometimes with the d of the benumbing influence of chloroform, and by division one or more of the contracted muscles, tendons, and fasciæ.

Tenotomy, myotomy.—In this operation the necessary relaxaon of muscular resistance and of accompanying structural ortening is effected by severing the muscle at its tendinous ortion. The principles laid down by Delpech for the performce of this operation are followed in the present day. It is markable that Delpech never carried out his own principles.† e discovery and application of subcutaneous tenotomy belongs Stromeyer. Many alterations in the mode of applying these inciples have been made since the original labours of Delpech d Stromeyer. Various knives for severing tendons (tenotomes), d a great variety of mechanical extension apparatus, have een devised. In this place only the means in most general use n this country will be described.

In describing the several distortions in the treatment of hich tenotomy and mechanical treatment may singly or conjointly be requisite, no nosological order will be adopted. We will commence with congenital club-foot (talipes varus congenitus), because it is one of the most common distortions which the surgeon has to treat, and because it has formed the basis of extensive pathological and therapeutical research. The consideration of the scientific treatment of club-foot will, therefore, best illustrate the principles upon which the management of all other distortions should be conducted.

No other deformity exhibits in a greater degree the incidents of orthopædic experience.

Congenital Club-foot (*Talipes varus congenitus*).

It is undesirable to attempt here even a sketch of the history of the acquaintance of our profession with club-foot. It will suffice to mention that the subject engaged the attention of

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* Constitutional, medicinal, and dietetic treatment, exercises, gymnastics, inunctions, &c.

† See the history of division of tendons, in a *Treatise on Club-foot and analogous Distortions*, by the Author. London, 1839.

Hippocrates amongst the ancients, and of Scarpa amo moderns. But it was not until the genius and e Stromeyer were combined with a sound acquaintance principles and practice of modern surgery, that the c treatment of severe club-foot became possible.

Anatomy of club-foot.—Former opinions on the anat club-foot may be advantageously passed over.* In 18 subsequently, the author laid down the essential charac the anatomy of club-foot.† The subject has since bee fully and successfully studied by Mr. William Adams. general result of observations of this matter is the confir of the opinions emitted by the author in 1837 and 1839 club-foot consists of a three-fold alteration of the for position of the foot, the heel being elevated, the toes turn and the internal margin of the foot raised from the g owing to abnormal action and shortening of the principal, of all the muscles of the inner and back part of the leg. Pe also, in at least the severer forms, those in which the much contracted, the plantar muscles participate in the pr affection. The ligaments, fasciæ, and integuments on th tracted side of the member are also shortened, whilst the s tissues on the opposite side are elongated and weakened. passive tissues follow the fortunes of the active organs muscles, on which they are in the main dependent, and b thus secondarily affected. The bones, before and after os tion, suffer in proportion to the intensity of the muscula traction, and probably in proportion to the earliness period of uterine existence at which the distortion comme and especially in proportion to the period that elapses birth, during which the passive osseous structures remain mercy of the active muscular agents. The bones further as age advances, by bearing the weight of the body in proper direction.

The departure from the normal form and relation of may be divided into—

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* See *On the Deformities of the Human Frame*, by W. J. Little, p seq. London, 1853.

† *Dissertatio inauguralis de Talipede Varo*, Berlin, 1837.

‡ *Medical Times and Gazette*, 1852; *Transactions of Path. Soc.*, 185

§ *Treatise on Club-foot and analogous Distortions.* London, 1839. number of treatises on club-foot have appeared since 1837, few of which any fundamental researches into the anatomy of varus.

Primary.

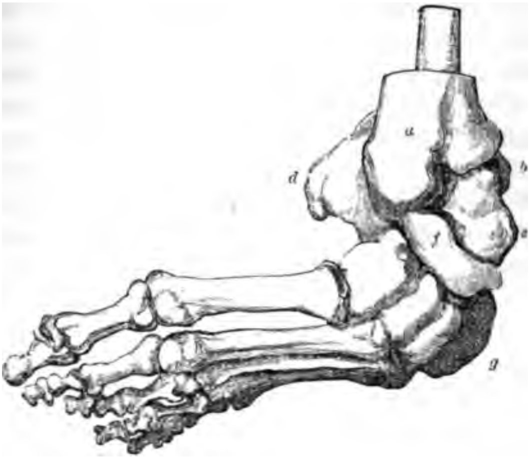
. The changes especially affecting the tibio-tarsal joint.

. The change of relation of the anterior bones of the tarsus, as regards the astragalus and os calcis.

Secondary, or those induced after birth, by spontaneous aggravation of the deformity, and by pressure upon the parts through walking in an improper manner.

natomical changes of bones in varus of practical moment
to the state of extension of the os calcis, taking with it
galus, through which the posterior extremity of the os
more or less closely approximated to the posterior sur-
he ankle-joint; and the anterior portions of the articu-

FIG. 168.



lt congenital Varus, viewed from the front and inside:—*a*, the tibia, cut
in order to show the relatively posterior situation of the fibula; *b*, the
al malleolus; *c*, the fibula; *d*, the posterior extremity of the os calcis,
abnormally inwards; *e*, the astragalus, unduly prominent on the dorsum
foot; *f*, the navicular bone in contact with the internal malleolus; *g*, the
, its proper superior surface applied to the ground.

ırfaces of the trochlea of the astragalus are projected
ankle-joint in front. Owing also to the forced inversion
ntire foot, the external malleolus is thrown backwards
the posterior tuberosity of the os calcis, and the
extremity of the astragalus slightly inclines towards
r margin of the foot. The forced elevation of the
part of the foot (calcaneum and astragalus) is common
s varus and to talipes equinus; but the characteristic
ty of varus is the displacement of the remaining bones

of the tarsus inwardly to the extent that the navicular
the astragalus, often touching the internal malleolus, w
it frequently acquires a new articulating surface. The
and cuboid bones accompany the navicular. Moreover,
cases the cuneiform, cuboid, and metatarsals, with the p
are drawn backwards, limiting the space of the planta

The changes of bones induced by improper walking,
pressure and bearing against the ground, by which al
times inflammation and ulceration of soft parts are occ
do not properly belong to simple uncomplicated c
Only when these injuries are considerable do they a
results of treatment.

The shortening of the ligaments, fasciæ, and integum
the posterior and internal aspects of the member ma
served when, before or after operation, attempts are m
the hand to rectify the deformity. In severe case
resistance to cure is offered by the posterior ligamen
ankle, the deltoid, the calcaneo-scaphoid, the superficial
plantar ligaments. The share of resistance offered by the
for example, is well shown when dissecting severe
varus. After removal of the superficial textures (integ
fasciæ, muscles, and tendons), much amelioration
results; but the ligaments of the ankle being intact, i
served that the foot still retains a varus form. But w
deltoid ligament is severed, and the navicular bone is li
a marked facility of replacement is evinced.

The general direction of the structures involved in
tortion is much altered. Thus, the leg-bones are
rotated from the knee-joint. The surgeon should not
find the tendons occupying their normal relations. Th
ing over the front of the ankle-joint are deflected i
whilst the posterior tibial tendon appears more deeply
owing to the incurvation, and to the backward dragg
elevation of the anterior part of the foot.

Etiology of congenital club-foot.—The primary cause
varus congenitus has been already touched upon, p.
consists in an alteration of the dynamic properties of
muscles, apt to be accompanied or followed by st
shortening,* and by fibrous and adipose degeneration of
Until the researches of Rudolphi, it was held that club

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* Little, loc. cit.

† Cruveilhier, *Anat. Pathol.*; W. Adams, *Pathol. Trans.*

us other distortions and malformations, were the conse-
ce of some 'occult influences,' lusus naturæ, maternal
ination, and intra-uterine pressure. An occasional effort
de to revive the last of these theories, that of intra-uterine
ure. It has been elsewhere shown* that accidental
anical causes do sometimes act upon the fœtus, giving rise
sily recognisable conditions, *e.g.* fissures, clefts, intra-
ne fractures, amputations of members from constriction by
mal bands or by the umbilical cord; and sometimes the
eration of pressure by the uterine walls and pelvic bones
e surmised.

e arguments in favour of the belief that ordinary con-
al club-foot is caused by some derangement of the cerebro-
l centres and dependent nerves, as opposed to the theory
dependence upon pressure of the walls of the uterus, may
us stated:

ub-foot often coexists with evident derangement of the
us centres, as in acephalous, hemicephalous, and spina
subjects.

ub-foot occasionally co-exists with an analogous distortion
e upper extremity, club-hand, in which the muscles con-
ed are the anatomical analogues of the parts contracted
e lower limbs. Now if it be admitted that the external
guration of double club-foot may suggest to the unphysio-
al and unpathological observer the idea of one of the feet
g overlapped the other in such manner that the uterus,
sing the liquor amnii to be deficient, has compressed the
eet into the form in which we see them, this explanation
not apply to the club-hands, which bear no such form
n be reasonably attributed to pressure of the uterine
Moreover club-foot often exists in one foot only, and
uterine-pressure theory does not explain why one foot
es. This theory is still less applicable to the highest
of club-foot, in which the great toe is more approximated
inside of the leg than pressure of the uterus will explain;
t the opinion of undue (spastic) action of the muscles before
ticulating ends of bones can restrict their action, affords
elligible explanation.

b-foot is met with in fœtuses before the fourth or fifth
of gestation, at which period the liquor amnii is

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* *On Deformities of the Human Frame*, pp. 256–314.

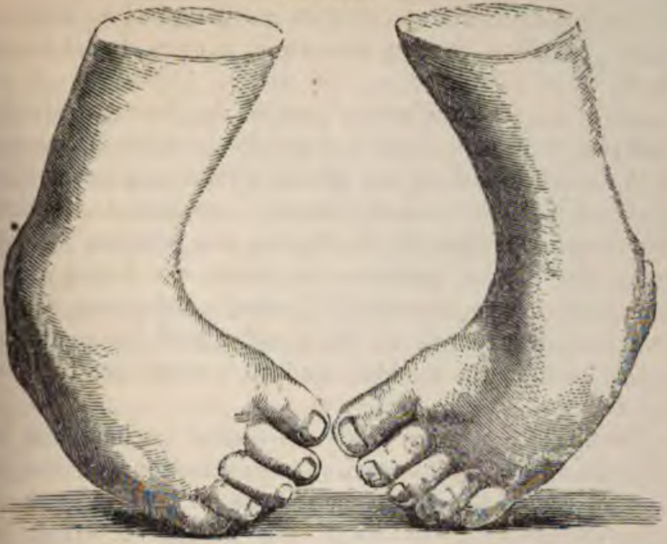
relatively so large as to exclude the idea of uterine consequent upon *supposed* deficiency of that fluid.

Congenital club-foot can often be traced to hered fluence, sometimes on the father's side, sometimes mother's side. We have traced it on the paternal s through four generations, the male infant, the fat grandfather, and the great grandfather. If it can be maintained that club-foot is due to the influence of pressure, deficiency of liquor amnii, pressure of pelvi and its repetition through successive generations, this i could only be propagated through the female side. W admit uterine influence in hereditary propagation o through an uninterrupted succession of male parents.

A comparison of club-foot with the distortions which after birth, unmistakably from diseases of the nervous s tends to prove that congenital and non-congenital clu spring from analogous causes. Distortion after birth, altered innervation of muscles, is more common in the extremities, and especially in the feet, than in any other p the frame. Club-foot is also the most common distortion b birth. After birth, talipes varus, in consequence of cer spinal affection, is more common than talipes valgus; b birth also, varus is more common than valgus. After bi foot-deformity, from disease of the nervous system, at oftener a higher grade on the left than on the right side. T is equally the case with congenital club-foot. Some o agency than accidental uterine or pelvic pressure is requir account for these analogies; they cannot be regarded as coincidences.

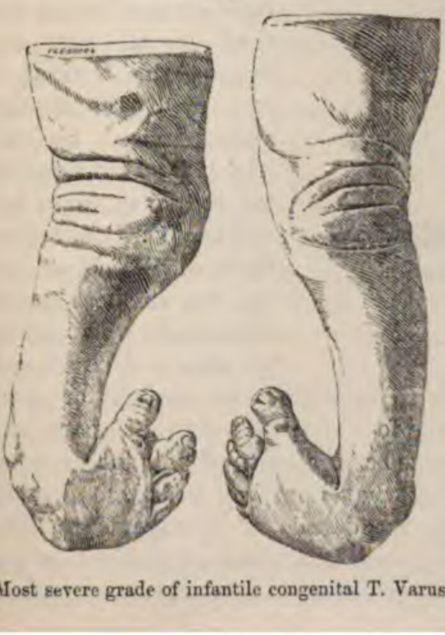
Grades of congenital talipes varus.—It is convenient for p tical purposes to divide congenital club-foot into three de of severity: the slightest, that in which the position o front of the foot when inverted is such that the angle form it with the inside of the leg is greater than a right angle, in which the contraction is so moderate that the toes can be brought temporarily by the hand of the surgeon i straight line with the leg, and the heel be depressed t natural position. The second class includes those in whi inversion of the foot and elevation of the heel appear the or little greater than in those of the first class, but in w no reasonable effort of the surgeon's hands will temp extinguish the contraction and deformity. The third

FIG. 169.



Congenital infantile Talipes Varus, of medium severity.

FIG. 170.



Most severe grade of infantile congenital T. Varus.

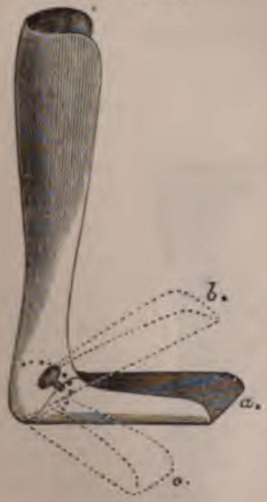
comprises those in which the contraction of s
displacement of hard parts reaches the high
that the inner margin of the foot is situated at
with the inside of the leg, sometimes is even al
with it.

Cases of the first and second grades may be re
verted into the second and third grades by delay
tion of remedies, and by the effects of improper

Treatment.—The indications are to overcome
of the muscles, ligaments, fasciæ, and integumen
tracted side of the member; to direct the b
proper position; to educate the patient's volunt
parts; to give strength to the muscles and lig
elongated side of the member, and to combat t
relapse.

A few slight cases may from the day of birth
linquished to the rubbings and manipulations
some require to be li
on a strip of tin or
bent to a right angle
padded; others requi
only beneath the sol
the back of the leg, as
bent strip of metal is
need lateral support
against the internal
foot, as by the applic
splint devised by th
Fig. 171). In the use o
lar contrivances to b
different surgical instr
the essential point con
ing the smallest amou
compatible with maint
paratus on the limb, no
at once either to force the part straight or even
tender infantile foot accurately fit the apparatus,
the apparatus selected admits of adaptation, to s
foot in a somewhat improved position. Pract
quainted with the details of management of th
surprised to discover how small an amount of pr
in young infants rapidly to improve the form

Fig. 171.



splint should daily once, or oftener, be removed to ascer- that undue pressure has not been used, to replace it when ened by the movements of the child, and to improve the ition as often as practicable. No unnecessary loss of time uld be permitted during this process, as at first the foot idly relapses to its most distorted condition.

If at the expiration of the fourth week distinct contraction of tendons remain perceptible in spite of assiduous efforts to rcome the deformity by manipulations, frictions, and steady t gentle employment of splint and bandage, or if benefit portionate to the attention bestowed be not realised, or if case unequivocally belongs to the second or third degrees varus, the aid of tenotomy will be required to effect restora- n. If the surgeon should entertain doubt whether the time operation have arrived, he may be determined by the obser- tion whether, on holding the foot in the normal position, it ings vigorously back into the abnormal one as soon as the ssure of the hands is removed. In unequivocal cases of the ond and third degrees he may, in most cases, decide affirma- ely at the moment of birth on the absolute necessity of future ration; and when operation is indispensable, the earlier the iod at which it is performed the better. Mr. Stromeyer tle has operated within twenty-four hours after birth with oid and permanent success. Our practice of late years has en to operate as soon as convenient during 'the month.' e surgeon, when deciding on the necessity of operation, st not be guided solely by the external configuration, but by amount of firm resistance opposed to restoration, by the th of the furrows existing in the sole and behind and above heel, and by the degree of tension of the integuments about internal malleolus. The deep clefts or furrows in question te intensity of contraction of muscles, and closer adhesion usual of integuments and fasciæ to the subjacent soft ctures and bones. They probably denote also that the rmity dates from an early period of uterine existence. n atrophy, the usual concomitant of contractions of long ation, is already present in severe club-foot of new-born dren, and is a measure of the length of time the muscles have n contracted and exposed to structural shortening and pos- le degeneration.

Nature of the operation.—The essential character of congenital ipes varus being a state of abnormal elevation of the heel, and inversion of the front part of the foot by undue muscul contraction, the operative interference required consists of th division of the tendons of those muscles which are mainly, i not exclusively, concerned in the production of the deformity, viz. the tendons of the anterior and posterior tibials and th tendo Achillis. In average cases these three tendons may be divided at one operation. In severer cases the operation should invariably be divided into two parts, the first consisting of the section of those structures which contribute to the inversion—the tibiales tendons; and where the sole is much contracted with a strong prominent band felt at the inner edge of the plantar fascia, that band may be included in this portion of the operation. The division of the plantar textures and elongation of the sole may in severe cases advantageously precede the section of other structures. The tendo Achillis may in such cases be severed in three or four weeks; in adults, two or four months later; the inversion having, in the interval, been overcome. The value of this proceeding, first recommended by the author,* consists in the os calcis, when the tendo Achillis is left intact, offering a *point d'appui*, or resisting point, from which the surgeon, during the mechanical after-treatment, is enabled to stretch out and unfold the contracted involuted sole. If this division of the operation into two or three parts is not observed in bad cases, incomplete recovery may result, the sole remains contracted, and the individual walk unduly on the heel, the range of motion of the point of the foot being deficient,—in short, a secondary talipes calcaneus be produced. This secondary deformity is always overcome with difficulty, sometimes it is irremovable.

In a few adolescent and neglected adult cases of congenital equinus and varus, even the peronei may need division, these muscles having become, from protracted duration of the deformity, tensely contracted and considerably shortened.

The following is the mode of dividing some of these tendons and the instruments which we have introduced as the most appropriate for the purpose. The operation is more quickly and more conveniently done by taking the three tendons in the following order, viz. the posterior tibial, the anterior tibial, and the tendo Achillis. Section of the posterior tibial is best performed by placing the child on a table of convenient height, ack, inclined towards the limb to be operated on. This ld be thoroughly rotated outwardly, resting upon its outer whilst a competent nurse holds the child's hands and the site leg out of the way of the surgeon. An assistant, ng a few small dossils of lint, a bandage, and the necessary es within reach, takes his place by the side of the patient, holds the thigh and knee of the limb to be operated on one hand, being prepared with the other to hold firmly dduct the foot, as may be required. The operator, when t to sever the left posterior tibial, seats himself in front, the foot in his left hand, and endeavours to feel the t prominence of the posterior tibial tendon with the left b; during the time he either abducts the foot with the , to put the tendon on the stretch, or takes advantage, ng the spontaneous movements of the infant, to observe re the tendon is thrown into palpable relief.

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* *Lancet*, May 25, 1839.

When, however, the surgeon cannot feel the tendon, it is tically quite sufficient to make out the inner edge of the , about a finger's breadth above the lower end of the inner leolus; or should there be any difficulty in defining this e of bone in consequence of the fatness of the limb, the ful insertion of the knife *exactly midway between the rior and posterior borders of the leg*, on its inner aspect, be an exact guide to the position of the tendon, not forting, as anatomy teaches us, that an incision made a little ront of this line might wound the internal saphena vein and ve; and if made behind it, would run the risk of dividing flexor communis digitorum instead of the tibialis posticus; the knife might even pass posterior to the former tendon, l, if carried deep enough, might wound the artery and nerve hout touching any tendon whatever.

Having thus determined the situation of the posterior tibial one or all of these methods, a sharp-pointed knife is passed ough the skin at about a finger's breadth above the inner lleolus, according to the age of the child. It must be made penetrate steadily down, *perpendicularly to the surface*, to a th varying from a quarter to half an inch. In doing this, it ecessary to be quite sure of sufficiently opening the fascia ering the posterior tibial and common flexor tendons; otherе, when the probe-pointed knife is passed in (as will be cribed in the next stage of the operation), it may either h against this dense unyielding structure, or glide over its surface behind the deep layer of muscles, instead o through the opening in front of them.

In order, therefore, to accomplish the *free divisio* fascia of the leg close to its insertion into the edge of and likewise the proper sheath of the posterior tibia beneath, the sharp-pointed knife should be passed to t above recommended; the handle must then be elevated depress the point of the blade; that is to say, the ins should be used as a delicate lever, the centre of motio the skin, which may be pressed upon gently by the bac knife; and in this way an opening of the requisite size made in the fascia at the bottom of the wound, without ing the external aperture.

Having thus far accomplished the operation, the pointed knife is withdrawn, and a probe-pointed one i passed into the puncture through the skin, superficial layer of adipose tissue, deep fascia, and lastly the sheath of the tendon, and be now inserted a little fur so as to get well between the posterior tibial and th When satisfied from the sensation communicated to th that the bone is on one side and the tendon on the ot that remains to be done is to turn the edge towa tendon, giving the knife a slight cutting motion, while same time the assistant firmly abducts and depresses th border of the foot.*

A distinct sensation of something having suddenly can be perceived at the time of the division of the but if the case should have been previously operated feeling may be very slight, in consequence of the ad existing between the original wound of the tendon a adjacent parts.

As soon as this peculiar jerk is detected by the assist should immediately relax the foot, and apply a dossil over the wound, holding it there with the fore-finger du division of any other tendons. If, as has happened, th is supposed to be cut, either from the escape of florid from the blanched appearance and reduced temperature foot, it will only be necessary to apply instantly a gr compress, and to roll firmly a bandage upon the foot and however, may require to be loosened if the colour of the shows any indication of strangulation. If the operator is mbidexter, he will find, in the operation for dividing the rior tibial tendon of the right limb, that he had better on the left side of the patient with his back to the nt's face, whilst the assistant sits down in front, and the thigh with one hand while he steadies the toes with her.

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* We have seen more than one straight sharp-pointed bistouri ca instead of two separate knives. The best of these was in the hands of

king, then, the mesial line or the inner aspect of the leg out three-quarters of an inch above the inner malleolus as rue position of the tendon, the sharp-pointed knife is to serted perpendicularly, with its back towards the sole of oot. It is thus made to divide the skin and deep fascia in ame way as was explained when cutting the left posterior l tendon. After this instrument is withdrawn, the probe-ed knife may now be used to finish the operation, which l other respects agrees with the section of the correspond-tendon on the opposite side of the body. The long flexor e toes, owing to its proximity, is often partially or wholly ed at this operation on the posterior tibial.

eis and Velpeau divide the posterior tibial tendon at its rtion into the navicular bone, the knife being inserted so to meet the tendon about an inch (in the adult) below and front of the inner malleolus. This plan is inapplicable to ants. In adolescents and adults this tendon is usually so minent to the eye and touch above and behind the internal lleolus, that it is an easy matter to sever it by inserting the nt of a narrow straight scalpel at the posterior edge of the don, directing it forwards between the tendon and tibia, so to divide it without risk of injury to the posterior tibial ery or the internal saphena vein. It is unnecessary to give rticular directions for division of the plantar fascia when ded, those given respecting operations on other tendons ing amply sufficient. The direction of the knife should be m without inwards, *i.e.* from the external margin of the foot wards the internal margin.

The division of the anterior tibial tendon in talipes varus ould follow the section of the posterior tibial; the patient ing in the same position, and the assistant still holding the mb, and pressing his finger upon the lint covering the punc-re already made above the ankle. The operator should feel r the most prominent part of the tendon over the joint, somewhat nearer the malleolus than in the normal insert a sharp-pointed knife, with its flat surface to outer edge of the tendon; and having passed it wel he should turn the sharp edge towards the tendon, fore-finger of the left hand is pressed gently over th warn him of the approach of the knife to the surf assistant, who has been steadily abducting the foot d operation, gradually relaxes his endeavours as he tendon yield; and as soon as he perceives the disti which is the result of its complete division, he shoul diately relax his hold, and apply a small dossil of lint puncture.

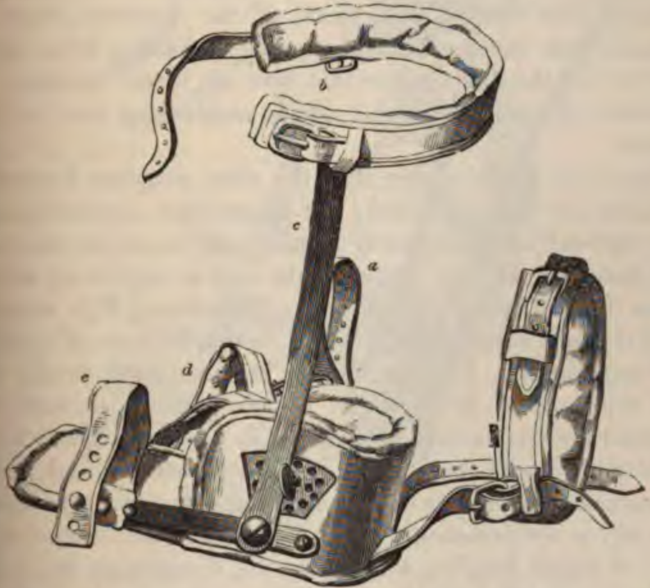
Division of the tendo Achillis is accomplished after the infant over on the abdomen. Whilst an assis deavours to bend the ankle, the surgeon introduces straight tenotome through the integuments from bel wards at the side of the tendon. As soon as the poin instrument is judged to have reached the anterior s the tendon, it is passed in front of it; the cutting edg directed to the tendon, severing the tense cord by on movements of the blade against it, and without woun integuments, except by the puncture of entry. The should carefully relax the pressure he may be exercisi the foot in proportion as he feels the part is cut throug

These operations, when properly done, occupy not m a few seconds each, and are usually absolutely bloodles has been written concerning the danger of wounding terior tibial artery. I have only once witnessed any from the circumstance. This accident occurred to colleague. Ligature of the vessel on account of a smal sized aneurism was required the third week after the o In that instance the wound in the vessel would have healed without aneurism if the surgeon had not too s the accident incautiously removed the bandage and the foot. When injury of the vessel is suspected or k have occurred, the removal of the bandage and co ment of the mechanical after-treatment should be three weeks.

A pasteboard or soft metal splint, previously mo the form of the contracted part, should be employed diately after the operation, to ensure quiet, and favour of punctures.

Apparatus required after operation.—The metal splints already
commended for cases relievable without operation are equally
plicable after division of tendons. Three days after opera-
n, one of these splints, not much straighter than the affected
t, should be selected, or if a splint capable of being adjusted
a screw be used (Fig. 171), it should be set at an angle or in a
ection that the child will bear without complaint. In infants
e the age of two or three months, a more elaborate and effec-
apparatus may be employed, when the pecuniary circum-

FIG. 172.



ttle's Shoe for Varus of left foot:—*a*, strap to be attached to the buckle *b*, ntended to moderate the action of the lever-spring *c*; *d*, two straps which start om within the heel-piece on the outer side of the foot near the sole-piece, and re intended to be secured to buckles on the opposite side of the instrument, for he purpose of holding the posterior part of the foot firmly against the inside f the shoe, whilst the strap *e*, and short spring to which it is attached, draw he front of the foot outwardly. The convalescent may take exercise in this pparatus.

ces of the parents permit it. The woodcut, Fig. 172, repre-
s the lightest, the most effective, and the most inexpensive
e more elaborate apparatus constructed for the purpose.
perpendicular lever and the toe-spring are derived from
pa's shoe; but as Scarpa's apparatus contains no con-
nce for depressing the heel, but relies simply on the effect

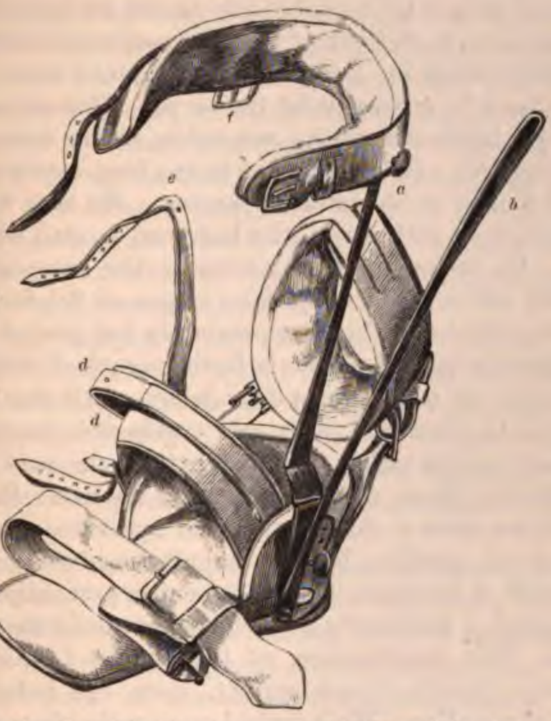
f the weight of the body acting during locomotion has introduced the movable thumb-screw, capab inserted into any required hole of the quadran above. This is an improvement upon the male screw, and the double-acting ratchet-screws often purpose. The simple arrangement of a movable has, in addition to lightness, the advantage o mobility of the ankle in the direction of bendin stance of much importance.

Cases of the first grade of infantile deformit rectified in two or three weeks, those of the in about four weeks, and those of the highe operation and the mechanical treatment having ing, two or three stages, within two or three treatment of adolescents and adults varies from months.

Relapse not rarely occurs after the most comple abduction has been obtained. It takes place in ages, especially when growth is most rapid, and early discontinuance of instruments, and to negle lations and of passive and active exercises. T called relapses result from previous incompletenes of restoration. No case should be considere until the mental development of the patient advanced for him to take an interest in his cure, voluntarily to hold the part in a perfect positio the natural movements of it. In relapsed case tenotomy is not commonly required. Often the found of ample length; sometimes the diminuti gastrocnemius, for example, wasted through want of adequate alternate flexion and extension—*i.e.* —being shortened and drawn up towards the popl common cause of relapse is doubtless the previ curative elongation of the fasciæ, ligaments, situated on the contracted side of the member, a by the corresponding relaxation and weakness o the opposite side. Continuous gentle re-applica bending apparatus, aided, as soon as flexion to t is reached, by exercise with a wedge of cork be of the sole, suffices to restore these cases usuall weeks—*i.e.* within the period the patient wo required to lie up if tenotomy had been repeate ory to be able, not only to spare the patient and friends the ern incidental to any operation, but to be able to avert, by hanical means only, without loss of time, the discredit ch attaches to the repetition of the operation.

n the treatment of relapsed adolescents, an apparatus that will bear the risks of walking exercise, and at the same time favour mobility of the ankle-joint in the required direction, is afforded by Fig. 173.

Fig. 173.



Dr. Little's double-hinged upright Shoe for severe rigid Varus of left foot:—*a*, stiff upright, hinged in two places, which when applied to the leg adapts itself to any degree of deformity; *b*, a spring curved outwardly, which when brought into contact with *a* can be then secured by means of a swivel-stud; *d d*, two straps for purposes similar to straps *d*, in last figure; *e*, moderating-strap, to be secured to *f*, as required. If the act of bringing the spring *b* into contact with *a* should occasion too much strain, *b* can be fastened at any required distance from *a*, by means of a tape. In the application of a varus shoe, success depends much upon the nicety with which the sole is applied to the sole-plate of the apparatus, and upon careful adjustment of the power employed. The foot-part of the shoe should be properly applied before the upright lever is secured. The moderating-strap is the last to be fastened.

After operation for club-foot, even in infants, continuous application of splints or other apparatus is required for four or,

five weeks; in older children, for two or three
less severe the case, the more often the appa
removed for cleanliness, and to examine lest und
employed. It is the boast of successful treatme
to be able to accomplish this result without a sing
The surgeon should watch that, in his efforts t
heel and abduct the foot, the part be not too long
one position, to the extent that the power of low
and of inverting the foot is lost; or, in other wor
engendered in exchange for the varus. This sec
has been attributed to the non-union of the sev
tibial tendon. It is really due to too long-conti
of the foot in an abducting apparatus. We have
children born with varus, who had been treated
tion. Its production is favoured by the same
debility which produces spurious valgus, or flat-f
growing children, who have previously had perfe

Instrumental treatment is further required d
a portion of each twenty-four hours, until th
enabled to plant the entire sole evenly and pro
ground, to thoroughly flex and extend the pa
habitually, when walking properly, to evert
numerous cases a child requires no apparatus a
five or six months; but the majority need som
aid, such as leg-irons to evert the entire extremi
telligence is sufficiently awakened—say, until th
years. The maintenance of the 'cure' depe
diseases, greatly, if not mainly, upon the ind
natural guardian. We have had cases under obse
on from infancy to puberty, owing to successive
have more commonly occurred abroad or in the
have witnessed examples of adults returning to
on, who have been successfully referred to the
with a few instructions as to mechanical attentic

After tenotomy no replacement of the part
tempted until after the puncture has cicatrise
been written respecting the propriety of immedia
It is unnecessary in slight cases, and impossible
In slight cases, nothing is gained by it; for if th
be immediately rectified, the part cannot be imm
The limb should therefore be gradually replaced
don is consolidating itself.

he influence, in interfering with union, of too-considerable too-early separation of the ends of a severed tendon, and cially of frequent motion, as in walking, is incontestable. eriments upon animals have proved that considerable lengths ndon may be excised, and union nevertheless ensue; but knowledge possessed of the great extent of the powers of economy is an insufficient reason for neglect of those rules ution which experience dictates. The immediate separation severed tendon to too great an extent should be avoided. or three-quarters of an inch may be safely borne, although rule gradual separation is preferable. The condition of a red tendon approaches that of a fractured bone; too great ration of the severed ends, depression of temperature ient to suspend active arterial circulation, too-early move- t of the parts, and inherent vice of constitution, may cause on, like bone, to remain ununited.

romeyer has suggested, that previously to operation the nt should be accustomed to wear the replacing instrument. plan is desirable when the practitioner is unfamiliar with reatment of deformities; for he thereby becomes versed e action and mode of application of the apparatus, and ndered certain beforehand of the appropriateness of the ivance.

th reference to the choice of the apparatus, Stromeyer has ly remarked, that every practitioner will select that of he best understands the action and mode of application. sagacious observation explains also one cause of the zeal which each writer advocates his particular appliance.

annot be too strongly insisted upon, that in a large number ormities, whether treated with or without operation, ex- ve instruments are unnecessary. More depends upon the patience, and perseverance of the practitioner than upon articular apparatus employed. Common roller bandages, or without starch and plaster of Paris, tin, wood, or gutta- a splints, aided by manipulations, may, in ingenious hands, y the place of the most elaborate contrivances.

may sometimes happen that no instrument is available, he after-treatment may require to be conducted entirely by pulations. Thus an adolescent case of double congenital was admitted into the London Hospital, under the care r. Critchett, presenting large ulcers with necrosis on the m of each foot, induced by pressure during the mechanical treatment after tenotomy. As the unhealthy chara ulcers depended upon want of air and exercise, and t tion of suitable instruments was impossible, it was not to wait for cicatrisation of the ulcers, but to repea and effect forcible manipulations of the members. was upon one occasion employed. By these mea were gradually straightened, cicatrisation of the thereby favoured, and within three months the lad hospital entirely restored.

After congenital varus, as after acquired deforn tive apparatus may be required; these for the most of jointed irons to support the weak articulations, to assist the action of the debilitated muscles.

The completeness of recovery in the great ma cases of congenital varus constitutes one of the surgical art.

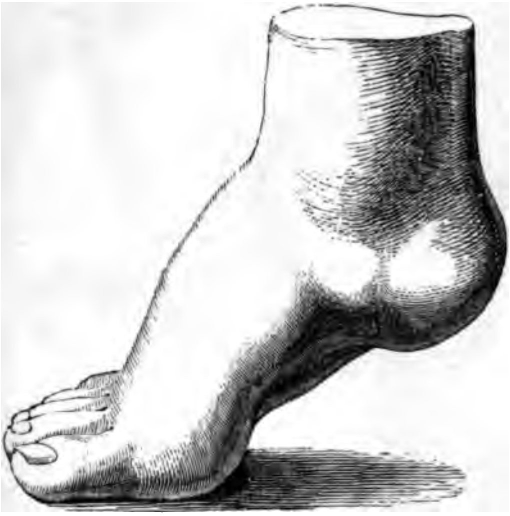
During childhood congenital varus may be en without other traces of deformity than smallness of greater squareness of the front of the foot, and sc complete mobility of the ankle-joint, the patien entire volition. When the case is unattended to age, the internal margin of the foot may never be c plied to the ground, owing to the impossibility in perfectly unfolding the os cuboides from its inferio position in the tarsus; in other instances, owing pr round head and neck of the astragalus having bee inverted in relation to the remainder of the bone, th undue convexity of the tarsus outwards becomes Every year reduces the number of adult cases of va treatment, so that the consideration of any mear the attendant difficulties may appear superfluous. has usually found a most efficient agent in a firm the sole beneath the os cuboides, pressure being time made upon the upper surface of the other tar

Congenital Talipes equinus, Talipes equino-varus, Talipes equino-valgus, Talipes calcaneo-valgus, varus.

By talipes equinus is understood morbid contr muscles of the calf, and consequent depression of adductors being unaffected. This is a very ra affection. We have met with two cases in the same family—the first born, and the last child, the eleventh. When it has not been treated in infancy, locomotion is effected on the anterior extremities of the metatarsal bones and phalanges. In severe cases the internal margin of the foot is slightly inclined inwardly, and the metatarsus is projected forwards. There is not, as in varus, any disposition to tread exclusively on the outside of the fifth metatarsal bone.

The existence of congenital talipes equinus has been emphatically denied. It is a question of fact and capability of discrimination. It may be suspected that the rare cases of congenital equinus which may have fallen under the observation of those who have denied its existence have been erroneously classed as varus. In congenital contraction of the muscles of the calf, owing to the morbid elevation of the heel, the narrow portion only of the trochlea of the astragalus is retained within the malleoli, and the front of the foot falls or is drawn readily either inwardly or outwardly; the more ready or usual direction being inward; just as we see in some sound children there is a preponderance of the adductors (tibiales) over the peronei, and the feet are consequently observed to be turned in more often than out. Consequently the surgeon who makes no allowance for the ordinary tendency of the feet to incline, and who con-

Fig. 174.

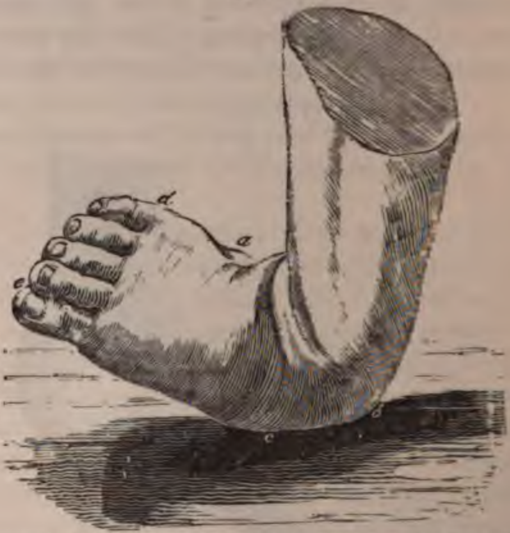


Congenital Talipes Equinus.

siders a case to be varus when he sees the foot with r
slight an inward inclination, does not believe in the e
of congenital talipes equinus.

The few cases of unoperated congenital adult equinus w
have seen have remained talipes equinus throughout
patients have continued to walk on the metatarsal extr
the great toe, as well as on the little toe.* The great
never been raised from the ground, as it is in congenit

Fig. 175.



Front view of a congenital Talipes Valgus of the right foot of a boy aged
d a, the outer edge of the foot raised from the ground; *e*, the gre
from the ground, although the internal edge of the foot is directe
b, the internal malleolus; and *c*, the internal extremity of the na
being the parts upon which the patient walked.

No original or secondary affection of the adductors h
the foot in, so as to resemble congenital varus or even
genital equino-varus. The patient, we repeat, still
the great toe and the little toe.

If congenital equinus be rejected upon the ground
be taken by those who deny its existence, then it ma
be asserted that neither does non-congenital talipe
exist; for there is no non-congenital talipes equinus i

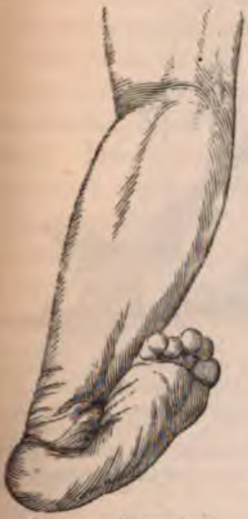
---

* We have recently examined an adolescent with well-marke
congenital equinus. It was further remarkable by constituting t
ample of the deformity in living members of the family, viz., the
paternal uncles, and one aunt.

ace of inversion or of eversion cannot be discovered, which hen very marked is termed either talipes equino-varus or alipes equino-valgus.

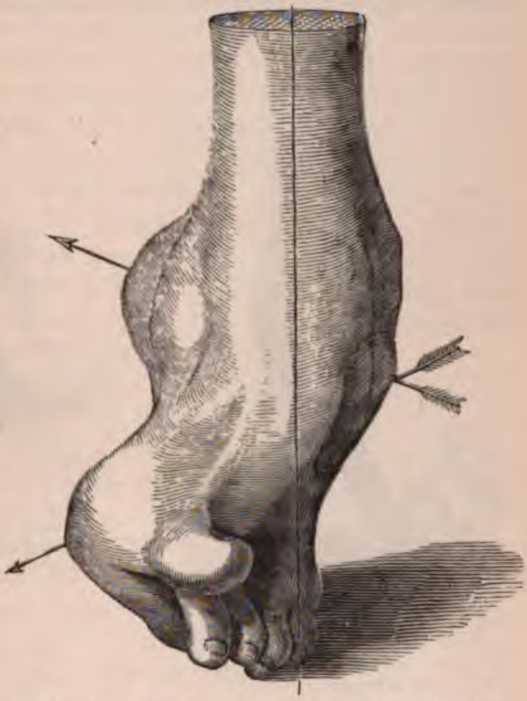
The dispute as to the existence or non-existence of congenital alipes equinus continues for the same reason that discussion is ndless in every department of natural history, as to whether a iven object belongs to one species or forms another species; ne observer recognising a radical difference, which another observer either overlooks or explains away as belonging to another species.

Fig. 176.



Extreme Congenital Calcaneo-Valgus.

Fig. 177.



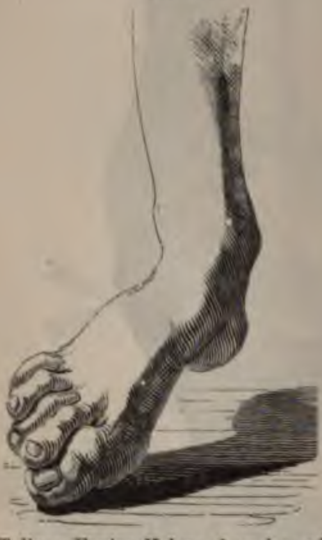
T. Equino-Varus. The arrows indicate the direction of the convexity of the tarsus and metatarsus, forwards and outwards; the perpendicular line through the axis of the limb shows the extent of the inward deviation of the metatarsus, by which the base of the little toe, being brought completely beneath the axis, has to support the entire weight of the body in walking; and is, in consequence of its attrition against the ground, a considerable cause of suffering.

Talipes valgus, equino-valgus, and calcaneo-valgus, are the terms applied to those distortions which contrast most with

talipes varus, or ordinary club-foot. The front of t
more or less turned out in each of these varieties,
being inverted as in varus. In valgus the perone
muscles mainly contracted; in equino-valgus the tend
is also tense, and the heel elevated, the toes at the s
pointing outwardly. In calcaneo-valgus the heel is
through the contraction of the anterior tibial, and
pointed outwardly from tension of the peronei.

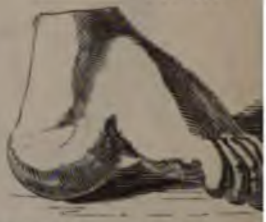
The foot deformities named respectively equino-v
equino-valgus are both non-congenital, and offer other

FIG. 178.



Talipes Equino-Valgus, from loss of power in anterior tibialis, and consequent contraction of calf muscles, and of peronei.

FIG. 179.



Fully developed Calcaneo-V
paralysis of gastrocnemii
quent contraction of muscles
of anterior tibial, and pero
In some instances the ant
shares the fate of the gastr

analogy, the chief of which is their dependence upo
spasmodic or paralytic contraction as the case may be.

The reader, on comparing Fig. 177 with Fig. 169, will
the similarity of form between equino-varus (a non-co
affection) and congenital varus, and might reasonably
that little reason exists as far as external form is conce
making any distinction between them. An essential diffe
that congenital varus is fully formed at the time of the
appearance in the world, whereas equino-varus, when it p
from paralysis, is gradually produced, slowly attaini

imum of distortion. In spasmodic equino-varus also the tortion resulting from either obvious or obscure disorder the nervous system is rarely complete *ab initio*; on the con- ry it is for the most part slowly developed. The analogy of ino-valgus (Fig. 178) in some respects with equino-varus is parent. In both there exists contraction of the tendo hillis; both are produced after birth from either spasms or alysis. In equino-valgus the toe is everted, and not inverted in varus.

The deformed, enlarged, and protuberant heel of talipes- lcaneo-valgus is the consequence of several years' locomotion the posterior extremity of the os calcis. This bone has in effect, the fully-developed deformity, a nearly vertical instead of the early horizontal position which obtains in the well-shaped foot.

The rules already laid down for judging of the necessity for enotomy in varus and of the number of contracted tendons to e divided, apply to each of the distortions now under considera- ion. The principles which should direct the mechanical treat- ent are equally applicable. The experience of the surgeon and he ingenuity of the instrument-maker are required to adapt the pparatus to the peculiarities of each case.

A variety of congenital varus occasionally presents itself, in which the inner margin of the foot is slightly raised, the sole contracted, and the dorsum prominent towards the outer side of the foot, but without elevation of the heel. In these cases the muscles of the ankle are unaffected. We have designated this affection calcaneo-varus. The treatment consists in making pressure by means of a pad upon the prominent dorsum, and in suitable manipulations. A beneficial result is soon observed; but the affection is prone to return. Division of the plantar fascia and of the long flexors of the great toe rarely exercises as much permanent benefit as is expected, because the quantity of plantar textures necessarily left unsevered suffice after cessation of the treatment to reproduce contraction.

Some irregular *congenital* foot-distortions are met with. In a few of these we find distinct paralytic loss of muscular power: in one case well-marked paralytic varus, with much atrophy of the soft and hard parts; in another, paralytic contraction of the hips, knees, and feet, with implication of the upper extremity. The only treatment applicable is to relieve contraction by manipulation, friction, and in unyielding cases by tenotomy, thus offering a chance to the muscles which remain partially

under the will, to support the individual in atte
imperfect locomotion. We have watched thes
birth to adolescence; in many the paralysis has
diminished.

Distortions originating at the moment of

We have seen that in the earliest times of the
genital distortions, they were successively attri
anger of the Deity, lusus naturæ, malposition in,
of, the uterus. In the present day, an enlarged
non-congenital as well as congenital distortions l
ably to the conclusion, that the numerous caus
found to operate in the production of distortion
existence, exercise analogous if not identical effec
fœtus remains within the uterus. These causes a
and maternal influences, disturbance of the nutritiv
circulatory, and nervous systems of the fœtus
accidents, entanglement by the funis and abnormal
uterine fractures, malposition and pressure, fixed
position, and inflammation. In order to illustrate t
ness to distortion existing at every epoch, we shall
a group of distortions, which unquestionably take
at the period intervening between uterine and
life, that is, *during* birth. We believe we can
the moment, as that moment which connects
pulmonary respiration. When we reflect upon
phenomena in the economy at the moment when it
itself to the immense changes involved in the abru
the oxygenating process of the blood from the pl
pulmonary cell surfaces, we should anticipate th
dation, interruption, or arrest of this transfer
important function should be attended with the g
the system at large, and especially to the nervou
most susceptible in the body.

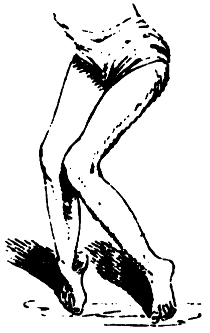
We know that a state of suspended respiration
is the common consequence of many of the accide
upon birth; and we might infer, from the evils of
after recovery from the asphyxia of drowning or of
what might be the consequences of the apnœa an
new-born children. Some of these appear, how
escaped notice, until the observations published
in 1843. The lungs suffer in the form of atelectas

ly in delayed or deficient closure of the foramen ovale, ssibly in straining of its walls; the nervous centres from ns and apoplexy, followed by impeded developments, y of individual parts, sometimes by impaired intellect and n, convulsions, and spasmodic contractions.

s scarcely necessary to add, that difficult and instrumental s, and those in which the cranial bones and brain, and the vertebræ and their contents, have suffered mechanical r, are more likely to be followed, if not by death, at least neral convulsions and other serious derangement of the us system, of which a prominent symptom are the 'in-l' or subdued convulsions of the nursery.*

common class of affections resulting from injury at birth, er the injury be mechanical or vital, consists of a peculiar ution of volition with tonic rigidity, in varying degrees art or of the whole of the muscles of the body, described he spastic rigidity of new-born children.' Both lower mities are more or less generally involved. Often one only is referred to by the parents; areful examination usually shows a er degree of impairment in the limb sed to be unaffected. This state of iar spastic rigidity of young infants even continue through the whole ion of life. We have known patients forty years of age thus affected from

FIG. 180.



Spastic contraction of flexors and adductors of the lower extremities, consequent on asphyxia neonatorum. Similar distortion may result from 'convulsions' during teething and other cerebro-spinal affections.

e amount of contraction in the hips, , and ankles is often considerable, he leanness proportionate to the con-ion. The flexors and adductors of the s, the flexors of the knees, and the rior muscles of the legs preponderate. thighs and knees cannot therefore mpletely extended, or the heels be ed to the ground. In some cases pper extremities are held down by reponderating action of the pectorals, major and minor, and latissimus dorsi; the elbows are flexed, the wrists partially flexed and pronated, and the

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* See *Transactions of the Obstetrical Society*, 1862.

the tendency both to rare micti
sometimes exists. The muscles
the affection varying in degree fro
one or more letters of the alphabe
articulating power. During the
tition is often impaired. The int
from the slightest impairment,
willingly acknowledges or fails t
becility or idiocy. The functions
except perhaps that of developm
depression of temperature may
want of proper exercise. The
generally, in average cases, is w
less than the average adipose
described as the healthiest of th
or having these disorders less sev
sisters. These subjects often lead
during the first weeks after birth;
languishes, often because premat
by impairing the maternal supply
difficult the infant's recovery fro
received. However, in the majori
tion of the vegetative functions,
the functions of animal life is per

that the child never thoroughly straightens the knees; e does not attempt to stand, or is incapable of standing t on the toes, or that the feet are disposed to cross each . Even children slightly affected rarely ‘go alone’ before e of three or four years; many are unable to raise them- from the ground at that age, and others do not walk indifferently at puberty. Locomotive ability seems to e in proportion as the intellectual powers are developed. ternal form of the cranium occasionally exhibits depar- from the normal type—such as general smallness of the depression of the frontal or occipital region only; some- of one lateral half of the skull, sometimes of one half of cciput only.* In slight cases the head has been well oped. The *ensemble* of phenomena points to injury more extensive of the cranial contents, and especially of the lla oblongata and spinalis.

all cases, even with great inertia as to the exercise of ion, common sensibility appears little if at all deficient. he contrary, a morbid sensibility of the organ of hearing of the cutaneous envelope appears to exist, evinced by rtling’ at the slightest noises, and extreme sensibility to h. This morbid sensibility may be due to a condition of al cord analogous to that present in narcotized frogs, in ividuals under the influence of strychnine, or those affected by nus. It may, however, be apparent only, dependent upon individual, when subjected to common noises, being less petent quietly and promptly to reason upon them, and by s reassuring the easily disturbed nervous mind, to escape m the exciting influence. In many cases the intellect has n intact. A peculiarity of these children—an uncommon r of falling—is often observed when they are seated on a ch, less when they are on the floor, and not observed when y are seated in an arm-chair; a circumstance clearly due conscious inability to balance and recover the position of the dy.

Morbid Anatomy reveals in these cases a corresponding deficiency in size he affected parts of the cranial contents.

ration. Sometimes, without eithe
having preceded, convulsions o
during the first hours, days, or w
Convulsions, as is well known,
dentition has made some progress
going another transition, that c
from nourishment by the mothe
unfavourable consequences of de
apt to show themselves. The i
unexceptionable history, except t
subjects of disorders of the nerv
perament, have overtasked brains
intemperate. These convulsions
ferer impaired in mental powe
rigidity, undistinguishable from th
asphyxia neonatorum. (See Fig. 1
add to the previous remarks on spa
tions that convulsions and other
of childhood may be followed by s
of single muscles or of sets of ass

Treatment.—The indications fo
chanical treatment of these di
paralytic contractions, and the n
ment, are the same as those la

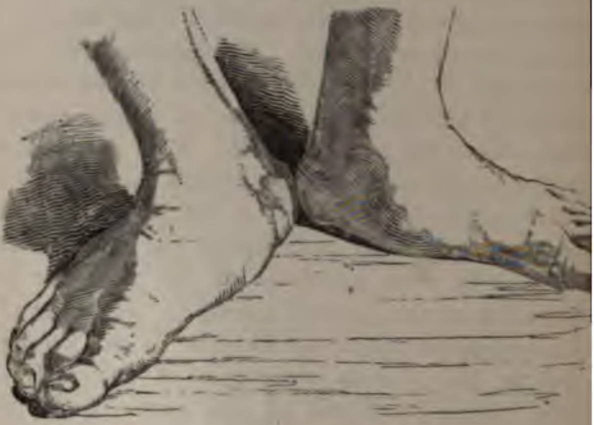
le is often the healthier one, and that in the case of a
odically affected muscle, tenotomy does not 'cure' the
n. It is often only temporarily beneficial, and sometimes
fers the preponderance to another set of muscles, merely
tuting one evil for another. In severe general spastic
ction, the surgeon has carefully to balance the good and
one against the other.

Flat-foot, or spurious Valgus.

is common deformity presents externally many of the
cters of congenital valgus, and of the acquired valgus
h results from paralysis of the anterior tibial muscle. But
semblance is only superficial. The person treads unduly
e inner margin of the foot, the toes are turned outwardly,
the arch of the foot is diminished, or, in severe cases, may
bliterated; hence the term flat-foot. True valgus springs
congenital contraction of the peronei muscles; spastic
congenital valgus from spasm of the peronei; paralytic
us from partial or total paralysis of the anterior tibial;
etimes combined with paralysis of the posterior tibial,
ing contraction of the peronei owing to the want of an-
onists; but spurious valgus or flat-foot is due to general
nt of tone in the fibrous structures of the body,—dis-
yed in the yielding of one of the parts of the frame
st exposed to strain, the plantar muscles and ligaments;
nce sinking of the arch, eversion of the toes, and secondary
traction of the peronei. After a time the displacement
the tarsal bones, connected with the sinking of the arch,
ds to painful or difficult locomotion and limitation of the
vement of the ankle-joint. Finally, the tarsus may be said
be convex inferiorly, concave superiorly, the anterior part of
e foot being then drawn up by the conjoint action of the
terior tibial and the extensors of the toes, and the heel held
nsely upwards by the muscles of the calf. Even in moderate
ses contraction of the peronei is distinctly felt; in severe
es shortening of the remaining muscles above enumerated
also evident. In the worst cases scarcely any mobility of
e ankle-joint remains. A slight degree of flat-foot is common
girls, especially amongst those of fine organisation in
e upper and middle classes of society; less frequent in boys;
d is curable amongst them by considerably reducing the

amount of standing and walking exercise, by su
horse exercise where practicable, by avoiding too fas
in the company of adults, by early hours, by avoiding
tive over-study, by generous living, fresh air, tonics,
to the state of the primæ viæ, embrocations, and mani
directed to the promotion of inversion of the foot and
tion of the threatened contraction. In greater relaxati
parts about the inner ankle, actual confinement to
and carriage-exercise for a month or five weeks, or t

FIG. 181.



Severe Flat-foot or Spurious Valgus.

spent on the sands or beach at the sea-side, will lay th
tion for cure. Laced boots, supported at the sides
leather or thin steel busks, are of great assistance in
An elastic horse-hair, india-rubber, or felt pad ben
inner margin of the foot tends to support the arch.
cork, often employed for this purpose, are harsh and in
We must utterly condemn a practice often resorted t
tempt of the pathology of the affection—that of seve
peronei and tendo Achillis in all such cases. The re
patients from moderate flat-foot when this operation
performed, is due mainly to the absolute repose of the li
which the operation is followed, and to the mechani
sures concurrently employed. But in a few rare cases in
practice, and in those of boys who have stood prematu
hind a counter twelve or fourteen hours daily, and amo

classes in public institutions who have suffered from ture labour, the deformity has existed so great a length so that the contracted muscles have become shortened and rendering tenotomy, with its promptness and certainty of t, a necessary adjunct to the mechanical treatment.

t-foot often exists for several years without attaining an intermediate grade of severity, when all at once a ularly long walk, a leap, or initiation into a standing ation, becomes the starting-point of a considerable and aggravation. Sometimes evidence of chronic inflamma- f the calcaneo-scaphoid ligament, or other plantar struc- or a painfully stretched condition of the plantar nerve, . This last symptom is recognised by the exquisite, rable, electric-like, painful, tearing sensation described e patient when he takes a long stride, or stands on the ed leg alone. We should not be induced to operate on ot even on account of its long duration, or of palpable ening of the tendons before enumerated, since even rigid action of muscles, healthy as to their innervation, will in a few weeks to judicious frictions, manipulations, disuse e part (required in this deformity owing to its special ure to aggravation by walking), and mechanical treat-

As an argument in favour of severing the Achilles and tendons in slight cases, we have heard the question put, t harm does the section do?' Now, although the tendo lis is very tolerant of the ever-ready operator's scalpel, it t be pretended that an unnecessary operation is a benefit. n extremely severe cases, the act of walking, after re- nent of the tarsal bones, tends to bear down again the arch, the aid of mechanical appliances is subsequently d for several months, or even sometimes for two or three

Relief is much more readily obtainable in the child in the adult. The apparatus available in these cases is me as that used for varus, but with the action of the gs, screws, or lever reversed.

cutaneous division of the peroneus longus and brevis is ed in a manner similar to the operation of severing the Achillis. The patient should lie over on the opposite n assistant holding the foot inwardly, so as to maintain tension of the parts. The tenotome should be introduced nt of the tendons, the section proceeding from before ards.

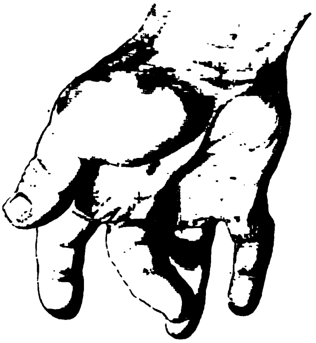
Contractions of the Upper Extremity from Spasm and Paralysis.

The principles which should direct the application of tenotomy to spasmodic and paralytic contractions of the upper extremity are those which are applicable to other parts of the body, except in so far as the functions of the individual muscles of the upper extremity, especially those of the wrist and fingers, are more delicate, varied, and complex than, for example, are those of the corresponding parts of the lower extremity. We should be prepared to expect that a surgical proceeding which aims at intercalating a piece of new tendon, with the object of reducing the range of action, and therefore the power of a rebellious spastic muscle, or for the purpose of thereby weakening a healthy muscle so as to favour a partially paralysed antagonist to recover its activity, would be less successful than in the lower extremity, the actions and movements in which are comparatively simple. The acquirement of the power of progression, even if it be incomplete, amply compensates for the sacrifices the patient makes; in bad cases he is satisfied with the possession of a limited flexion and extension of the hip, knee, and ankle, and can be aided by mechanical appliances. But in the case of the wrist and fingers the individual derives little benefit from these simple movements, and he cannot be materially assisted by any complicated mechanism hitherto invented. We have divided the biceps at the bend of the elbow, the rigid well-defined pronator radii teres at its muscular portion, the tendons of the flexor carpi radialis and ulnaris when most prominent close to the wrist, and have found the resulting benefit proportioned to the attention subsequently bestowed upon manipulations, passive exercises, and painstaking education of the enfeebled non-contracted extensors. Except in cases of many years' duration, in which the retracted muscles were reduced to inextensible fibrous bands, it has seemed that as much ultimate benefit was obtained by manipulations and exercises as by the employment of an operation, and at a greater expenditure of time. The prognosis must be based on the amount of improvement that may be expected in the affected portion of the nervous centres. As an encouragement to treatment, the surgeon should remember that cases occur in which the disorder of the nervous system and nerves has ceased, and that he has to deal only with consequences. This observation applies also to many congenital contractions.

Deformity from Disease of the Palmar Fascia.

not uncommon contraction in the upper extremity consists permanently flexed condition of one or more fingers, with le and palpable thickening and hypertrophy of the fascia ting the palmar surface of first phalanx of the affected r and of the neighbouring on of the palmar fascia. times the whole of the fin- and thumb are implicated, the itself is contracted, and the f the member as a prehensile, even as a tactile, organ almost royed. The ring and little rs, the middle finger, index, thumb, are usually affected in ency and degree in the order rhich we have placed them. articulations are commonly fected, although occasionally that of the first phalanx, with econd phalanx, or this with the third, has exhibited slight itic enlargement. On endeavouring to straighten the fingers, urgeon feels that a general resistance is offered by the tissues e entire palmar surface of the hand and fingers, and especially ie indurated palmar fascia itself. Any existing tension of the r tendons cannot be felt along the fingers, but in the palm, icularly in the upper part, above the edge of the most indu- d part of the palmar fascia, one or more prominent and tense ons may be felt. This deformity is usually attributed to in- often to a trifling wound, to irritation by the use of a whip iving, of a walking-stick, or mechanical tool. These mechan- auses, or local irritants, if really operative, can be regarded as occasional determining or exciting causes. The essen- r primary cause is a constitutional one, allied to the gouty heumatic diathesis. We may not venture, however, to t that the constitutional cause is identical with that of or rheumatism, as the persons affected have appeared ilarly free from other manifestations of those affections. disease of the palmar fascia, unlike gout or rheumatism, is less. Many patients affected with considerably contracted ar fascia in both hands present similar induration of the

FIG. 182.



Contracture of palm and fingers from disease of palmar fascia.

corresponding fascia of the soles; a sufficient pro
complaint is essentially independent of the mechan
assigned for it,—unless, indeed, we assume that
walking by stretching the sole can act upon the pl
after the manner of a mechanical irritant. The
character of the affection, the precise resemblance
with another, the occasional existence of hereditary
family, the frequent occurrence of the same deform
and son for several generations (four), as well as the
confirm the opinion of its constitutional origin. W
witnessed this complaint in the female. Those wh
indulged in strong wines and spirits, or beer, are
subjects of it.

We regard it, then, as a painless chronic indur
fascia, leading to compulsory, gradually-increasing
fingers and hand. Through this disuse the flexor
tendons, which are probably free from the origi
assert their preponderance over the equally idle e
become gradually affected with secondary shorteni

Treatment.—Even in tolerably advanced cas
manipulations twice or oftener daily, the applicati
adjustment splint, or straight splints of wood, t
percha, will, if suitably and perseveringly used, re
traction and deformity. But at the advanced
many patients present themselves for relief, the
of mechanical apparatus encounters many dif
rigid unyielding cases of long duration, tenotomy
efficacious. We cannot by its means alter the
state, or directly remove the induration of the f
are enabled to remove by tenotomy the second
contraction, to take the case entirely out of the in
patient's will, so far as the contracted muscles a
and obtain a starting-point for further benefit b
treatment. A puncture half a line in width su
passage of a firm tenotome beneath the tendon
The tendon is thus divided from below upwards.
or unnecessary handling of the part after the
which means air or blood might be disseminated
palmar tissues, is permissible. The operation, li
cutaneous operations, is bloodless. We have invar
puncture heal within forty-eight hours. Conside
of the contracted finger, the tendon of which has

is at once perceived. Manipulations and mechanical treatment complete the cure. We have frequently thus effected entire restoration of the hand and fingers. It is remarkable that the indurated fascia softens, and the hard ridges and corresponding furrows in the fascia disappear, under this treatment. It is obvious that the afflux of blood to the part excited and maintained by the frequent manipulations, frictions, and bandages, alters the nutrition of the part, and removes the previous morbid deposit. It is also probable that caution as to diet and wine whilst under the observation of the surgeon, assists this process of recovery. The causes being constitutional, and the attention of the patient being liable to slacken after a lengthened recovered use of the member, the complaint occasionally returns. We have re-operated on a patient thrice in eleven years; the individual expressing himself amply compensated for the operation by nearly as many years' good use of the part. This operation is a valuable illustration of the success of subcutaneous tenotomy compared with Dupuytren's painful operation, even when performed by so able a surgeon as the late Sir A. Cooper. We have had under observation two cases in which, by means of a large crucial incision of the palm, the indurated fascia had been dissected out and removed. The operation had no better result than that of causing a large contracted cicatrix, more rigid than the former state of things, and quite irremediable.

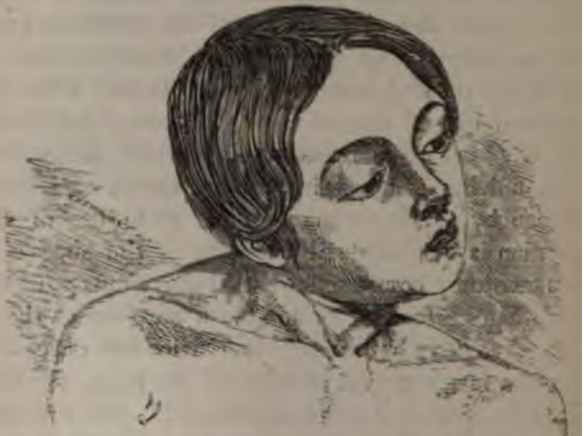
Wry-Neck.

Torticollis, or wry-neck, is a not very uncommon distortion of the head and neck, originating, like club-foot, from a variety of influences; some acting through the muscles—congenital, spasmodic, paralytic; others acting through the ligaments and bones—rheumatic and strumous. Occasionally the point of departure of a case is strumous affection of the lymphatic glands, and sometimes loss of textures from sloughing after burns or a gun-shot wound.

Congenital wry-neck.—This is the most common form of wry-neck. It is perceived a few months or more after birth, and, when suffered to proceed unchecked, gradually increases during childhood, adolescence, and adult life, until it attains the proportions of a formidable deformity. Many cases of wry-neck, reputed to be congenital, have appeared to originate from accidents at birth, in consequence of breech presentation, turning, &c.

We will describe an adult case, in which the righ cleido-mastoideus is the head and front of the offendi is probable that other muscles are always either pri secondarily involved. The entire head leans to the r and slightly forwards, the right side of the neck is s hollowed, whilst the left side is unnaturally convex, patient not unfrequently complains of pain in this s

Fig. 183.



Wry-neck from spastic contraction of sterno-cleido-mastoideus.

These changes in the form of the neck are more pronou the upper part, *i.e.* opposite to the base of the cranium being the region most influenced by the contracted m The chin is drawn to one side and approaches the left sho the right ear is approximated to the sternal extremity clavicle. The sterno-cleido-mastoideus of the affecte (right) has lost its symmetry, being reduced to a compar narrow, hard, tight cord, three inches in length, the mu the opposite side measuring five and a half inches. prominent cord is double below, representing the double of the muscle. In the adult a marked upward bend clavicle is often seen where the clavicular portion of th tracted muscle arises, induced by the constant abnormal tr to which the bone has been subjected, and the inferior p of the muscle itself appears of cartilaginous or osseous ness, and is lost in a large bony process on the protub clavicle. If we examine the neck and shoulders posterio observe that the cervical vertebræ have yielded to the dra of the contracted muscle; this part of the vertebral column presenting a convexity on the left side, which is compensated for by a curvature in the opposite direction lower down. The right side of the head, neck, and right shoulder are considerably smaller than the parts on the opposite side; the right shoulder and scapula being unduly raised. A singular effect upon the face results from this difference in size, combined with the impediment to the function, which the abnormal position of the head involves. In the adult case from which we describe, so great is the difference in size between the two sides of the face, that on the right side the external canthus of the eye is distant from the external angle of the mouth three inches, whilst on the left the distance amounts to three and a half inches. The inclination of the head to the right causes the right eye to be habitually situated on a still lower plane than would be the case if atrophy of the affected side were alone operative. The atrophy and the slight bending forwards of the head interfere with the direction and use of the right eye, and cause a peculiar expression of archness and sense of difficulty and suffering. These features of the deformity are, as already mentioned, proportionally less marked in early life.

The principal muscles of the neck are probably involved, the trapezius and scaleni, as well as the sterno-mastoid. In this and other respects congenital wry-neck offers much analogy to congenital club-foot. The principal contraction affects in both cases muscles which pass over more than one articulation, the sterno-cleido-mastoid in one case, the gastrocnemius in the other; hence in the neck the mischief of morbid contraction may effect a higher degree of deformity than if the contracted muscle influenced one articulation only; in the leg the contracted gastrocnemius does not always limit its evil influence to the foot, but may contract and distort the knee. In both wry-neck and club-foot other muscles participate in the deformity; but the range of influence of these being less, or being counteracted by antagonistic powers, their contraction is not so apparent. It is an interesting question of physiological pathology, whether there is anything special in the anatomy and function of the sterno-mastoid and gastrocnemius, that they should obtain the distinction of entering into so large a proportion of cases of congenital and acquired deformity. The gastrocnemius, by its great development, its greater nervous supply, and its relation to the upright stature and locomotion of man, is certainly entitled to a peculiar and elevate comparative and human myology; so, when we refl the size of the sterno-cleido-mastoid, its relation to vessels of the head and neck, its deriving its ner mainly from a special nerve (spinal accessory), and r the influence of this muscle upon the act of respira cannot deny it a pre-eminent function amongst its ne ing muscles.

We have elsewhere shown* that not unfrequently w appears to result from straining or injury to the neck difficult labour, from traction of the head by instrumen is superfluous, after what we have said of the causes c genital club-foot, p. 666, to refute in detail the theory would attribute wry-neck, like club-foot, to accidental uter pelvic pressure. Congenital wry-neck clearly originates causes acting through the nervous system.

Treatment.—It is probable that, as with slight conge club-foot, so slight cases of congenital wry-neck, if detected, are removable by frictions, manipulations, and sequent education; but all the cases we have seen, varyin age from four to forty-five years, have exhibited so contraction and proportional secondary deformity, that have in no case delayed division of the sterno-cleido-mas It has always seemed justifiable to gain at once, by mea this operation, a large measure of relief; thus affordin encouraging starting-point for the after-labours of the tendant in overcoming the shortening of the integum platysma, fasciæ, associated muscles, and ligaments on the low side of the neck, and, in this way, gradually acting upo altered relation of the articular facets of the inclined vert

Division of the sterno-cleido-mastoideus is performed sub neously, upon the principles practised by Stromeyer in div of the tendo Achillis, viz. effecting the division by the sma possible wound in the integuments and the narrowest through the subcutaneous tissues, and avoiding any ext bleeding or extravasation of blood into the areolar tiss admission of air into it. Neglect of these precautions w be calculated to excite suppuration and prevent imme healing of the puncture, and delay untowardly the employm of the necessary after-treatment, until, perhaps, the se might be reunited and implicated in the surrounding ons, the case thus becoming less amenable to the neces- mechanical treatment than before operation. The spot for the operation should be that at which the tendon rigidly across the important subjacent organs, and consequently most space is afforded for introduction of otome beneath the tendon without risk to those organs. -neck this spot will be found from a half to one inch the clavicle. It is also more easy to sever the muscle y by keeping at this distance from the bone. In some we have found the sternal portion only developed and contracted; a few weak fibres attached to the clavicle , before the knife reached them, yielded to the tension ained by the assistant. In cases in which the clavicular of the muscle is broad, it is safer to divide the sternal lavicular portions each by a separate puncture, rather ass the knife by one puncture made in front of the neck back as may be necessary to reach the whole of the ular portion. This precaution is justified by the anterior sterior edges of the muscle not being on a plane surface; though the fasciæ of the lower part of the neck may y bind down sufficiently the vessels and nerves, and so hem out of danger, it is well to remember the liability of ng with abnormal distribution. The complete division is panied by a very sensible crack, and the head at once es a much improved condition. We have measured im- tely after operation, and have found the difference in between the affected and sound muscle reduced more one-half. The puncture should at once be covered with a ess of lint, and a common bandage be applied. We found no harm result in the case of the sterno-cleido- id in allowing the ends to separate as far as they were ed to yield. In young and flexible subjects, we have adhesive plaster and a common roller-bandage an amply ent mechanical contrivance to aid in rectification of the

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* *Trans. Obstet. Soc.* 1862.

Apply a long strip of adhesive plaster around the fore- and occiput, its maintenance in position being better d by a bandage passed over the vertex and beneath the the two being pinned together where the one passes over ther, above the ears. Next attach around the waist a er band of adhesive plaster, not so tight as to interfere the movements of the ribs; over this a turn or two of

speaking of wry-neck caused by
mastoid) will be drawn towar
articulation, the original wry-n
brought to the median line, or
even across it, towards the affe
porary wry-neck in the opposi
ovoid form of the cranium rende
any length of time by any appa
apparatus will shift its direction
tially disengage itself. Hence
manipulations exists in wry-nec
No apparatus effects so benefici
upon the distortion as the hands
Whilst one holds down the sho
sitting behind the patient, should
the sides of the head, and direc
in the required directions. The
a lower seat. Such manipulatio
caution and technical skill. I
pain in order to produce much
ployed three times a day. Th
which we have described is mos
these manipulations. It may be
as quickly readjusted. We hav

or forward inclination of the head, but is powerless to the abnormal rotation of the head round the hori- axis.

ired or non-congenital spasmodic wry-neck.—We have seen cases of active, violent spasm of the sterno-mastoid in es, oftenest in unmarried females of middle and ad- age, causing severe wry-neck. The spasm is commonly irregular, convulsive, never ceasing entirely whilst the is awake. The disorder has usually commenced about of thirty in subjects not obviously hysterical, persons llent intellectual and social character, whose families eemed prone to other cerebro-spinal affections. We watched several of these cases for many years. The and deformity have in many cases gradually increased, rendering the patient's existence distressing, through nt motion of the head, disturbance of sleep, and pain in eck, apparently due to strain of ligaments and nerve- bance, and sometimes accompanied with pain referred to pper part of the spinal cord itself, as in some cases of al irritation.' Now and then the spasm is so considerable the ear of the affected side is drawn down by a series of r so as almost to touch the clavicle. The patient's volun- efforts to arrest the pulling down of the head appear to ase the disorder. Sometimes the co-existent affection of trapezius draws the head at the same time backwards, prevents the chin approaching the sternum. In inveterate s, such as have existed many years, we have employed eral and vegetable tonics, galvanism, and electricity, with temporary benefit. However, as might be expected, rous diet, hygiene, and freedom from mental disturbance, riate the symptoms. Complete relief is afforded by sub- neous tenotomy of the affected sterno-mastoid; but even measure is only useful for a time; for after two or three nths, or as soon as reunion of the severed part is complete, spasmodic shortening and jerking return. Stromeyer had atient who submitted to two repetitions of tenotomy for the e of the temporary relief afforded by the operation. The hor once operated on an elderly female who had suffered n spasmodic wry-neck upwards of twenty-five years. She been unable for many years to sleep in the recumbent tion, but dozed in a high-backed nurse's chair, provided h side-supports for the head. For a few nights after the

In every case which the author h
dies, the value of attention to the
For this purpose, half a grain o
night has been used. It is not
hydr. perchlorid. and of argent.
cases, is due to their stimulant
alimentary mucous surfaces, rath
action upon the nerve-tissue se
Relapse is not uncommon after e

An interesting instance of almost perf
mere section of the sterno-cleido-mastoid
is fully recorded by Mr. Campbell de Mo
Chirurgical Review, July 1866. The suc
of the external branch of the spinal acce
nerve, about a quarter of an inch in len
years afterwards with only faint traces of

Paralytic wry-neck is rare;
three cases. The head is draw
muscle, which is deprived of its
occurs in which, in consequence
helplessly to one side more th
infants, probably from mechanica
tures in the neck. Such cases
lysis, but differ by the history

my as it is in a case of contracted gastrocnemius, which
mply lost its antagonist, and which can be relieved by a
e mechanical support without operation.

-neck *from disease of the cervical vertebræ* is caused by
ous, and sometimes by rheumatico-strumous disease of one
e cervical vertebræ, from which the head inclines to the
d side. The chin is directed to one side, although this
is less marked than the sideward falling of the head.
ging of the opposite side of the neck, and in general
ance, these cases much resemble congenital wry-neck,
e distinguished from it by their history, the pain on
, the aspect of strumous or constitutional disorder, by
by the instinctive aversion of the patient to the
n's handling of the head, and concomitant glandular or
forms of strumous disorder in the one case, or rheumatic
ion in the other. The pathological changes common to
se of the vertebræ in each region, and its peculiar dangers
situated in the neck, are described in a subsequent essay.
t caution is necessary in handling these cases, lest the
tegrating bones give way suddenly to the pressure, or the
ative process which may be going on be interrupted.
h benefit to the disease itself, and gradual improvement in
position of the head and neck, may be effected by a well-
sted supporting and rectifying apparatus, as well as by the
gnised medicinal, dietetic, and hygienic treatment of the con-
tional malady. We have twice witnessed death as sudden as
oplexy, in cases in which suitable support of the head had
neglected, and the patients had persisted in maintaining
rect position, having walked about supporting their heads
the hands. The most efficient apparatus consists of a
ed metal plate, secured by straps beneath the axilla and
d the chest upon the shoulder of the side to which the
inclines. From this shoulder-pad an iron upright piece
ds upwards, by the side of the neck, to the parietal region.
Lower end of this upright is attached to, and moves upon,
houlder-plate by means of an endless ratchet-screw; the
r end is connected with a pad intended to be adjusted and
ed against the parietal region. In adults and very severe
s, this apparatus may be attached to a common spinal
ort for the chest and pelvis, for the sake of greater fixity
more powerful leverage. Sometimes an iron stem is re-
ed to extend upwards on one or both sides of the head,

with connecting straps to be applied beneath the
occiput, so as to receive the weight of the hea
opportunity for the ingenuity of the instrument-
afforded by these cases. In the present day we do
monly find it necessary to employ the cumbrous and
machines, consisting of an iron scaffold and gibbet
pension of the head, to which surgeons resorted as
the commencement of the present century.

Knock-knee, In-knee (*Genu valgum*).

This frequent deformity, of which instances are met
all ages, consists of an inward yielding of the knee-j
consequence of weakness of the ligaments and muscles
respectively connect or surround the articular extremities
femur and tibia. Its causes are identical with those
produce in-ankle or flat-foot (talipes valgus spurius), p. 6

Abnormal states of general nutrition in children and
cents, dependent upon insufficiency or improper quality o
are a common predisposing cause of this deformity. Som
it appears probable that the constitutional weakness, or
of tissue, has been engendered less by unsuitable sup
quality of food than by imperfect assimilation, owing to
cient aëration of the blood, as in children reared in co
dwellings, both in town and country. In many case
abnormal nutrition proceeds to the length of developi
unmistakable rachitic condition, known by the co-existe
the peculiar curvatures of bones which characterise th
ease. Our observation of the numerous gradations of
knee met with in young children, varying in outward app
from the most flourishing health to the most miserable,
and dwarfed extreme rickets, has convinced us that even
slighter forms of knock-knee a degree of impaired assimi
of food and an abnormal state of blood, similar to that p
in rachitis, exists. In these slighter cases of knock-
traces of rachitis will be found in prominence and deform
the cartilages of the ribs, flattening of the sides of the
and sinking-in of the sternum. One or more severe att
bronchitis, or broncho-pneumonia, have frequently been wit
tice regarded by the friends as the forerunner of the 'we
of the limbs.' In many instances the earliest link in the
of causation has been an error in the infant's diet; nam

ution, for an insufficient supply of breast-milk, of farinacea
in *water*, with the addition of little, if any, cow's milk.
imes we may ascend a degree higher, and discover an
tary pathogenetical influence. We have several times
ed knock-knee in small, delicate, prematurely-born chil-
the limbs, as a consequence of general weakness, having
d to the superincumbent weight of the trunk. Such cases
d not be confounded with the *inverted* flexed and con-
d knees which occur in children who, in consequence of pre-
re birth, have suffered from asphyxia neonatorum (p. 688).
k-knee often shows itself before the child has attempted to
this act being occasionally delayed by it as much as three
r years. When the deformity attains a certain grade, it
increase rapidly from the effects of walking, or it may
se so gradually as not to excite the parent's anxiety, until
gth, about the age of seven, ten, or twelve years, the child
ain 'thrown off the feet,' and becomes incapable of walking
out crutches or other support. The deformity often takes
in tall, rapidly-growing lads from the age of twelve to
teen, who may have exhibited no previous tendency to it.
e exercise, and fatigue in standing and walking, with late
and the poisoned atmosphere of ill-ventilated places of
ess and dormitories, appear in such individuals to have
ibuted to the complaint. Undue strain upon a sound limb,
nsequence of some other defect in the opposite limb throw-
ncreased exertion and weight upon it, may produce this
mity.

atment of knock-knee.—We have heard it maintained, that,
ule, children recover spontaneously from this affection. In
ll proportion of cases, spontaneous recovery of good power
lking takes place; but an examination of such instances
hown us evident traces of the affection in some persistent
gement of the internal condyles, with inability to take
walks on several successive days, without weakness and
on the inside of the knee. Slight cases will recover under
oved dietetic and hygienic influences, with the aid of
ble manipulations, and the discontinuance of prematurely
ing the child to walk. Sometimes we can, in addition, ad-
geously recommend the recumbent posture during certain
periods of the day, and combine with this repose the
ng a soft pad between the condyles, the limbs being
ded, and the ankles being gently drawn towards each other

articulated at the knee, furnished
adjustment to the inward inclina
by straps and buckles, may be
makers'. On the whole, even in
especially in aggravated cases, n
well-constructed iron to extend
side of the limb, sometimes on
bottom of the shoe, the hip and a
knee *fixed* in a somewhat impr
further rectified from time to tin
demands, by means of the adju
surgeon should see that the appa
regard to the anatomico-patholog
of the case. For example, irons,
to take suitable points of suppo
the outside of the thigh and the
fibula.

Severe cases require the knee
when standing, during a perio
months; then freedom of motion
a similar though variable period
yet a few months, before discont
total average duration of treatm
childhood may occupy two year
employ daily frictions and mani
knee becoming stiff in an extende

ourse to it. In adolescents the most severe cases will over with the aid of manipulations, exercises, and mechanical aratus, without confinement to the couch; but until a ight limb is obtained, recumbency, by removing the weight he trunk, greatly accelerates recovery. We are bound em- tically to protest against the operation of removal of a ge-shaped piece of bone from the upper part of the tibia, formed by M. Meyer for the cure of this deformity. It is a icient condemnation of this severe operation to remind the der that knock-knee is not dependent upon curvature or ormity of the tibia, but upon a removable displacement of relation of the articular extremities which enter into the ee-joint. Consequently, an operation of the kind performed y from the joint is at best a clumsy proceeding, and not hout danger. Division of the external lateral ligaments, other operation recommended for knock-knee, is also un- cessary.

Occasionally the knee-joint yields outwardly instead of in- rdly, constituting a deformity exactly the opposite to knock- ee. We have named this affection, *Genu extrorsum curvatum.* e treatment of it should be conducted upon the same prin- ples as that of knock-knee.

On *Orthopædic Operations applicable to the Removal of Curvature of Bones.*

Under the section on Rachitis in this work the value of mechanical treatment of curvature of the long bones of the lower extremities will find appropriate mention. In very early childhood whilst the curved bones are still in the softened stage, the straightening of them with the aid of splints, strapped or bandaged on the parts, may when the treatment is conducted with gentleness and patience be successfully accomplished, or 'irons' may be substituted for splints. The bent rachitic bones of the forearm may also, in the early stage of the disorder, be straightened by splints or with the help of spring instruments. So also the long bones of the lower extremities in adolescents affected with the singular and pathologically speaking little understood disease variously denominated 'mollites osseum, osteomalacia, rachitismus adultorum,' may be easily straightened by mechanical means.

It is different when, in ordinary rachitis, the bones have reached the stage of normal induration or 'eburnation.' On

A case of this nature was submitte
Little. The case was that of a young
and free from deformity in the upper
relief might be obtainable from remov
fibula and subsequently placing them
ment after the manner of accidental
deciding on the propriety of such an
whether bones thoroughly 'eburnate
surgically, for the cure of distortion,
the manner of an ordinary compound f
bearing on this point, such as the histor
and its reparation, were available to he
manner in which reparation is effecte
decided that reunion of the artificially
The operations took place at the N
and fibula of each leg were severed
periosteum having been scrupulously

The operations presented no unex
owing to the depth at which great pa
and the blunting effect of the hardene
The leg first operated on did not heal
abscesses, and the throwing off of s
not suffer. After six months the pa
limb, the inversion of knee and flat-f
She returned to the hospital after six
second limb operated on. The experie
lost upon the second. This time she
abscess. A year and a half after the
a stick, having two straight limbs.

Mr. Little operated on an analogous
mity. A boy suffered from inability t
having become deformed during infa

ı encouraging page to the orthopædic surgery of bones. other departments of orthopædy, it may be hoped that ed attention to such deformities in their early stages nder the opportunity of important surgical interference quent than we have witnessed.

Anchylosis of the Knee and other Articulations.

successful labours of orthopædic practitioners have con- l to improve the knowledge of the real condition of joints e cessation of various forms and degrees of inflammation generation. The erroneous notion, that long-continued of a joint alone sufficed to induce such alterations in its ır surfaces as to lead to bony union, and the remarkable r and immobility which result from the agglutinated tracted extra-articular structures—fasciæ, muscles, and nts—especially when dense, fibrous, deeply-extending ses co-exist, favoured the supposition of the common nce of true bony, irremediable anchylosis. We know solute bony union of articular surfaces is a comparative even in pathological cabinets.

practical purposes we may divide the conditions in which contracted from disease are presented to the surgeon, with to the restoration of form and motion, into three classes. ıose in which the resistance to motion is furnished solely ıly by the extra-articular tissues. 2nd. Those in which, ition, more or less considerable changes within the ıtion have occurred, viz. transformation of the synovial , vascular adhesions, fibrous adhesions, erosion of carti- of bone, mineral or bony deposits. 3rd. Absolute osseous sis.

first class of cases is common. We have met with ıus instances of knee and elbow-joint contraction, in- respectively by severe, deeply-extending burns, by onous erysipelas, by 'swelled leg,' in which the history case, the state of obvious contraction and adhesion of ra-articular tissues, together with the absence of dis- ent or deformity of the articular extremities of the eft no doubt in our minds that the articular surfaces, standing the paucity of motion, or its entire absence, e from organic change. In these cases, restoration of

of the synovial membrane so
improbable that it will have esc
tification of position, and comn
motion follows, but not alwa
active orthopædic treatment ha
of the second class consists of
synovitis (?) and diseases of
matic and gouty contractions,
violence.

The strumous distortions of
siderable mobility within a limi
and prominence of the interna
from wasting of the member al
They are usually straightene
much prominence of the cond
Partial mobility is usually reco

The rheumatic cases which
principally of two kinds, thos
arthritis' subsists, and those r
inflammation excited by expos
childbed, or an early stage o
during the comparatively early
secretion and free mobility wit
a later stage, in proportion to

inferred from correct pathological knowledge, the
rthopædic treatment is in the inverse proportion
mical degeneration which the rheumatic joint has

cond kind of rheumatic cases of partial anchylosis,
have commenced with very acute affection of one
often the knee, the loss of motion occurs rapidly,
ently complete. It seems, in these cases, that an
ction of the synovial surface, with rapid exudation
ke plastic material, takes place, causing firm agglu-
he ends of the bones.

the examination will usually show that absolute
of the knee, from whatever cause the anchylosis has
does not exist. The surgeon can with certainty
hat the joint is movable if an energetic effort to
ighten the limb produces a sharp pain through it.
luce some favourable conclusions as to the state of
we find the patella movable. This bone may some-
ved upon its perpendicular axis when no motion is
pon the horizontal one, and when no flexion or
the knee can be effected by ordinary handling of

e no other mention of stiffness of joints from
ticular rheumatism, acute and chronic, than to
t as this affection usually leaves the synovial mem-
t, no deformity, as a rule, remains, the exception
e ankle; here the weight of the body comes more
ly into play than elsewhere, and sometimes gives
umatic in-ankle or flat-foot.

eumatic contractions, those which are the least
treatment, belong to the peculiar form of the
minated 'chronic rheumatic arthritis' by Adams of
'rheumatoid arthritis' of Garrod.

, in reference to orthopædic treatment, a correct
f the condition of a joint contracted from disease
ned from the history and the external appearance,
eful manual examination. In the hip, the diagnosis
s more difficult, because the history communicated
acious in consequence of the greater liability to
agnosis during the first stage of disorder in and
articulation. Thus we have seen hip-contractions
primary hip-affection had been originally sciatica,

muscular and fascial rheumatism of the bulk of muscles of the hip and loin, or one of the forms of rheumatism of the joint itself, or 'morbus coxæ,' or the result of accident. To these causes of hip-contraction, which are not always diagnosed, we may add the peculiarly grave intra- and extra-articular exudation which occasionally occurs at the close of malignant scarlatina, and the less serious persistent drawing up of the thighs which occurs (without pyæmia) during a tedious confinement to bed from fevers and phlegmasiæ, especially in persons whose growth is not complete. We have also met with severe rigid hip-contraction, with pain and wasting, which had commenced during pregnancy from uterine influences; also after childbirth from puerperal disturbance; and in unimpregnated, as well as in unmarried women, even from gross fæcal accumulation in the intestines. Whilst reminding the surgeon of the various causes of persistent hip-contraction, we may complete the list by adding congenital contractions and luxations, paralytic and spasmodic contractures, some of these being hysterical, and some very grave affections, proceeding from disease of the brain or spinal cord, sometimes co-existing with angular spinal curvature. We have not enumerated these numerous causes of hip-contraction, as if they were so many pitfalls to the surgeon; but in order that, knowing what may have produced a given contraction, the young surgeon may be forearmed for diagnosis and successful treatment.

Treatment of partial and complete anchylosis.—The several forms of contracted joints of the extremities above enumerated admit of three modes of treatment: 1st. Mechanical extension, including manipulations and shampooing. 2nd. Tenotomy, succeeded by gentle, gradual mechanical extension. 3rd. Violent extension under the anæsthetic influence of chloroform, sometimes preceded by tenotomy.

The majority of joints affected with incomplete anchylosis, even the knee, elbow, or hip, still more the smaller articulations, and even after three or four years' duration of the contraction, admit of as full and prompt restoration by gradual gentle employment of mechanical extension as by either of the remaining modes of treatment above indicated, with the advantage of the treatment being conducted without pain, suffering of any kind, or confinement to the house. In severe knee cases of many years' duration, subcutaneous division of the hamstring muscles may advantageously precede the mechanical

nt, the surgeon bearing in mind that here, as in other
ons, success depends more upon the manner in which the
ical treatment is conducted than upon operative inter-
n. In a small proportion of cases, those in which ap-
t total immobility exists, or in which it is obvious that
l calcareous deposit has taken place, violent extension,
the aid of chloroform or ether, may be employed. We
a few detailed observations on the mode of conducting
of these processes.

chanical extension of partially anchylosed joints.—Long ex-
nce in the use of mechanical apparatus shows how little
l apparent power is required to overcome the most rigid
ractures of joints. The first condition of success is the
ect adaptation of the appropriate apparatus to the size and
ral movements of the part. It is of much importance
that, when practicable, the apparatus should only limit
movement of the affected joint towards the contracted side,
it should not immovably fix the part in every direction, but
uld leave some 'play' to the limb in the direction which it
ished the part should take. No curable anchylosis, free from
y union, can resist gradual, gentle pressure; we only resort
tenotomy, in addition to mechanical extension, for the
pose of saving time. A little consideration will explain
w apparently slight continued pressure can effect so great a
ult as the straightening of a knee contracted for twenty
rs from former articular disease or injury. The uninitiated
geon is accustomed to regard such a joint as 'nearly anchy-
ed;' perhaps he does not reflect that, if bony union have not
en place, the opposing structures are 'soft parts,' *i.e.* short-
ed muscles, ligaments, fasciæ, cutaneous textures, and cica-
ces, all liable to yield to steady pressure. It is probable
at as soon as this gentle pressure is applied, the contracted
uscles, shortened merely from position and repose, *not being*
asmodically affected, resist elongation, but they speedily tire,
nd give up the unequal struggle; the non-muscular parts,
owever dense they may be, probably undergo some change of
ascularity, some interstitial change in their nutrition as a
onsequence of the *gentle violence* they undergo, through which
heir mechanical power of resistance is diminished. An in-
rease of temperature and of bulk of the part undergoing
echanical extension is usually perceived, which we believe to
e due to increased flow of blood consequent upon the stimulus

of the state of tension in which the resisting tissues are maintained. This augmented flow of blood is unaccompanied by inflammation or even by pain when the part is at rest. Such appears to be the process in the structures on the contracted side of the member. The treatment probably receives aid from the muscles on the uncontracted side. The direction of the distortion was originally determined by the stronger set of muscles, or by those most advantageously situated, having overpowered the weaker set. When the contracted muscles yield in their turn to the mechanical instrument, the muscles situated on the uncontracted side tend to recover their lost sphere of action, and assist replacement.

The knee-joint, being a simple hinge, while the thigh and leg each offers a great length of leverage, is advantageously formed for successful orthopædic treatment by mechanical extension; and consequently we meet with no partially anchylosed knee which cannot be straightened and rendered fit for use without the aid of tenotomy or chloroform in a period varying from one to three months.

The anatomical relations of the hip-joint render it less favourable for orthopædic treatment than any of the ginglymoid articulations. At the hip, the shortness of the lever afforded by the small depth of the pelvis, and the difficulty of fixing the pelvis, explains why, when power is applied to the thigh with the view of extending the abnormally flexed or contracted hip, the lower part of the vertebral column, back, and loins, yield anteriorly, causing an extreme hollow in the loins (lordosis). In fact a small part only of the power employed is effective on the contracted hip-joint, the greater part being expended in dragging forwards the lowest dorsal and the lumbar vertebræ. We may mention, in illustration of the comparative difficulty of straightening the hip, that in an instance of uniform fibrous and vascular membranous adhesion of the head of the femur within the acetabulum after death, the partially anchylosed pelvis and thigh having been removed from the body, we were unable to extend the hip by any power we could exert with our hands, until the capsular ligament and some of the adhesions within the acetabulum had been severed with the knife. The same kind of adhesions in a knee would have yielded to the power fruitlessly employed at the hip.

Great ingenuity has been displayed in the manufacture of the apparatus. Occasionally considerable demands upon the of the mechanist are required. The continued attention rthopædic practitioners who, during the last five-and-twenty rs, have trodden in the footsteps of Scarpa and Stromeyer, nging pathological and anatomical knowledge, with expe-nce, to the aid of the instrument-maker, has revolutionised, plified, and thus far perfected orthopædic apparatus. As neral rule, elaborate instruments should be avoided. They often strictly articles of luxury, not obtainable for the tment of the majority of cases that present themselves in vate, and especially in public, practice. We may affirm that en *nothing* can be effected for the relief of a deformity hout a complicated instrument, very little can be effected h its assistance. Yet in numerous instances, as in con-ital club-foot of adolescents, in considerable knee-contrac-s, and subluxation, the necessity of well fixing one part st another is acted upon, or the complicated character of deformity itself, entails corresponding need of an elaborate trivance.

Different mechanical forces are employed—the lever, the ew, and the spring; the last two often resolvable into the er, screws and springs being employed to modify the action the lever. The discussion of the relative advantage of the erent modes of applying these forces would lead us away om our immediate object.

It should be borne in mind during the employment of these forces in orthopædic apparatus, and especially in the use of the screw, that it is available less as a means of abruptly forcing the deformed parts into their natural position than as an adjusting contrivance. In any case in which the screw is *forcibly* employed, unless for a very brief period, excoriation, sloughing, or intolerable pain, will inevitably result. In some *patient* individuals, vesication, and even superficial sloughs, may be induced over projecting bones without complaint of pain—an urgent reason for anxious examination of a part subjected to pressure, especially by the inexperienced orthopædist. Large sloughs are more than inexcusable.

Every apparatus should be padded, so as to avoid pressure upon prominent points of the bone, and adapted to each individual case. The orthopædic apparatus, like that for a fractured limb, should compress the part in its circumference as little as possible, and never tightly encircle it. It should act gradually, *in proportion as the deformity itself changes its form.*

We have endeavoured in our previous remarks to show, that if a contracted member,* a knee for example, is evenly secured in a suitable apparatus, accurately adapted to the degree of bending of the joint, the processes which ensue in the joint when a moderate tension is imparted soon favour the moving of the joint in the direction contrary to that which it may have long maintained. A contracted knee resting upon its posterior aspect in an apparatus, tends by its own weight to regain a straighter position.

At the outset, the surgeon should be content simply to apply the instrument to the deformity, and not to apply the deformity to the instrument, as is too often attempted by novices in orthopædic practice. In this gentle manner of proceeding, the first difficulty in the treatment of every case of deformity is overcome,—the patient suffers nothing from the attempt to straighten the part; the simple inconvenience of wearing an apparatus, the irksomeness attendant upon necessary confinement of the affected part in an unfamiliar instrument, is his only trouble, and one which is speedily, in a day or two, overcome. Having once applied a well-fitting instrument, the screws or straps by which it is adjusted to the now improving member require to be advanced or tightened as opportunity offers. An impatient advance of the pressure will, by production of pain, and necessity for relaxation of the instrument, occasion loss of time. The principle of action in the progress of mechanical treatment should be that of never advancing too rapidly, so as to risk the necessity of receding. By gentle means, and uniform steady advance, the patient's confidence, so essential to prompt recovery, remains undiminished. By subjecting the member to no greater pressure than can be easily borne, no temptation to loosening the apparatus is afforded to the timid, and no risk is incurred of occasioning excoriation or inflammation in individuals possessing greater endurance, or in young children, whose cries may be attributed to other causes. In this manner, in suitable cases, the opposition offered to restoration by fasciæ, tendons, ligaments, and ill direction of articular surfaces, apparently irresistible, may, with the further aid of manipulations, be removed.

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* The greater number of contracted joints, when not affected with bony anchylosis, if left to themselves, may be regarded as contracting joints; for the contracting process is ever progressing until it attains the maximum.

e choice of mechanical apparatus the surgeon should guided by that principle which actuates him in the n of therapeutic agents in any internal or external viz. the use of that means the action of which he best ands, or in the use of which he has had most ex- e. A common splint, properly applied, will effect more than an instrument of greater pretension indifferently d.

all these considerations, it is apparent that much harm ult, in the great majority of deformities, from the habit ies pursued of keeping a deformed part many weeks in on in an apparatus without the removal so necessary for poses of cleanliness, manipulations, and readjustment. the evil consequences of too long retention of instru- often combined with unsuspected excessive pressure, the has witnessed the production of an opposite kind of de- , as the conversion of varus into valgus, and a degree of of the part, which has required weeks of painful manipu- and stretchings, before the natural movements have been —sometimes, indeed, restoration of motion of an articu- as been rendered impossible.

slighter the deformity, the more necessary is frequent l of the apparatus, because by removal and appropriate lations we insure retention of mobility. In severe cases, h we expect only to effect straightening, and do not te restoration of mobility, frequent removal of the us is unnecessary; for too frequent removal may be hurt- allowing the recently elongated tissues to recontract the time the apparatus is removed from the part.

ion of the hamstring muscles.—We have shown that in a number of knee-contractures from disease and accident, of the hamstring muscles may be required as a prelimi- gradual mechanical extension, or to abrupt violent ex- under chloroform. In all cases after tenotomy, exten- hether gradual or abrupt, should be delayed until the of the punctures in the integuments. In the knee this is seldom complete until four or five days after the n. The following rules may be given for severing the ng tendons: Place the patient in the prone position, and ssistant make firm extension upon the joint, or desire ent to endeavour to bend the knee, by either of which the tendons will be rendered prominent. In general

follow the directions laid down for the division of t
Achillis (p. 676). In severing the tendon of the biceps
insert the tenotome in the adult an inch above the
point of contact of the tendon with the fibula, remembe
proximity of the external popliteal nerve, and keeping, th
the tenotome close to the tendon. The semi-tendinos
very superficial is readily severed by a puncture,
springs up most prominently; the semi-membranos
more bulky and fleshy, as well as more deeply seated,
a larger sweep of the end of the tenotome. It is
necessary to recommend caution as to the important
arterial, and venous structures of the popliteal region.
section of the inner hamstrings, the pressure of the as
hands upon the limb being continued, bands of fascia an
make themselves prominently felt in the ham. Trou
numbness in the calf, and unusual pain during extens
followed the unnecessary division of these structure
desirable to apply promptly a pledget of lint and
pressure by a bandage over the punctures, to prevent
blood into the areolar tissue of the ham, which affords a
venient nidus for suppuration. By adopting this in
covering and pressure over the puncture, we have ne
nessed delay in healing beyond four or five days, in
moderate temperature. Very cold weather may cause t
punctures in limbs of weak circulation to appear, at th
several days, as if they had been effected an hour previo
attempt at adhesion being made. It is therefore prope
weather to envelop the limb in flannel, and assist the
tive powers of the patient by generous diet.

*Forcible subcutaneous separation of the tibia and femu
bony anchylosis of the knee-joint.*—This operation,
proposed and carried out successfully by Langenbeck an
of Philadelphia, has been performed in this country wi
modifications by Mr. Little at the London Hospital. Th
tion consists in making a small incision in the integum
fibrous tissues at the side of the articulation, parallel
plane of the natural articulating surface of the tibia. Th
of this incision should correspond with the width of a
sharp-cutting, well-tempered ordinary chisel, say two t
lines in width, which being driven in different di
between the ends of the femur and tibia, united by

erial, so effectually weakens the connection between the erent surfaces, that straightening and bending of the limb with the exercise of 'gentle violence' with the hands, be ily effected. When the surgeon remembers that the *joint* been destroyed by the diseased process which produced the y anchylosis, he will not be surprised to learn that this sur- l subcutaneous chiselling asunder of bones is not followed any of the serious consequences known to follow wounds of joint, and that with or without simultaneous section of knee dons, as may appear requisite, the limb may be placed in the ired curative position. It may seem superfluous to remark t the operation is perfectly safe in the hands of the surgeon o avoids injury of the important nerves and vessels about the ticulation. It cannot fail to become a standard operation for ief of knees affected with *bony* anchylosis in a bent position, d is in every respect infinitely preferable to the operation of ee resection when it has been performed for mere anchylosis.

Division of muscles in the vicinity of the hip-joint.—Though in ip-contractures the majority of the muscles proceeding from he pelvis on the flexed side of the part are contracted, expeience teaches that few require operative interference. We have any times severed the origins of the adductor longus, adductor revis, and pectineus, the tensor vaginæ femoris, and the supeior origin of the rectus femoris. But of late years we have ommonly restricted the operation to the tendon of the adductor longus, for the relief of tense abnormal approximation of the thighs, in cases of general spastic rigidity of the lower extremities. The adductor longus, from its position, exerts a relatively greater influence in morbidly adducting the thighs than other muscles. Its division is a satisfactory starting point for subsequent benefit from manipulation and use. It is effected according to the general principles of tenotomy, and requires no particular description.

Section of the tensor vaginæ femoris and rectus is suggested in certain cases of paralytic contracture of the hip, in which atony of the adductors of the thigh exists, a state of things opposite to the last-mentioned kind of case. Here the thigh is drawn from its fellow, the trunk tending to fall to the ground, as it were, between the thighs. Where contraction of these muscles exists, the paralysis of the adductors and other muscles of the hip (psoæ and glutei) is usually so considerable, that little

radical good results from the operation. It should
as a rule, be superseded by manipulations, fric
mechanical appliances.

Division of the flexor tendons of the fingers and
phalanges, when contracted from articular complain
treatment similar to that of the larger articulations.
it is the flexor tendon which is implicated. Enough
stated concerning the large ginglymoid articulations
many details of treatment of these small articulation
sary. In operating on the fingers, we have to consid
hand whether the articular disease has left the joint
dition to resume its function as to movement; for if w
expect to recover mobility, a straightened finger is not
to one partly bent. We require also to calculate the
the tendon when operated on in the course of the the
ing agglutinated to the theca, and the finger subseq
that account not regaining movement. In the foot,
frequent affections of the toes for which surgeons are
are those resulting from improper shoes worn d
growing period of the foot—in childhood and adolesce
great toe is often thrust inwardly, and overlaps the ne
metatarso-phalangeal articulation being inflamed and
deteriorated as to the normal condition of the articula
with consequent impairment of mobility and very tr
lameness. The joint is inclined to stiffen in the
position after subsidence of the irritation or inflamm
individual being prevented standing tip-toe, or ascend
without pain or inconvenience. This condition of th
before and about puberty, be remedied by rest an
topical applications, followed by manipulations; the
tion of a partition between the toes, so as to keep the
in a proper line with the margin of the foot; and the
use of a suitably wide shoe. In long-standing cases,
the extensor tendon of the great toe becomes rigidly
and structurally shortened, and has become dragged
away from its normal situation above and paralle
metatarso-phalangeal articulation, the section of thi
may afford relief.

Another common troublesome defect in the toes,
produced, though sometimes hereditary, is fixed flexi
second toe. In children under the age of ten or twe

defect can usually be remedied by light gentle bandaging t tight) of the part, upon a padded whalebone splint, night day, for a few weeks. In older subjects, and in peculiarly d cases, section of the flexor tendon, opposite the first lanx, followed by bandaging on the splint, is a prompt and ain means of cure.

he little toe is often extended upon the metatarsus, or thrust rally and inwardly and sufficiently prominent to become tinually a source of pain and irritation from the shoe. This is often a congenital affection. Division of the extensor lon and bandaging affords relief.

he toes, and particularly the great toe, are often contracted ases of varus, congenital and acquired. These contractions relieved by the means taken to cure the talipes, and somees by gradually improving their position with suitable dages.

orcible extension.—Under the head of *manipulations* and tchings, the value of *gentle* employment of pressure and ements with the hands (passive exercise), both as a means uring slight deformities, and as an important auxiliary to er methods of treatment, has been shown. If a larger sure of pressure or force be used with the hands, the treatt becomes that denominated *violent extension.* Here, as where, it is difficult to draw an arbitrary line, and say where le manipulation ends, and violent extension begins. In the tice of manipulations, the competent operator may frequently l himself of the smaller degree of sensitiveness displayed by e patients, or of the momentary abstraction of the patient's tion from the muscles (a circumstance instantly felt by hand of the operator), and apply an amount of force which roximates to, or may be considered as, violent extension. *violent* extension with the hands is rarely efficacious the removal of considerable contraction and deformity, ecially in full-grown persons, because either the pain proced is intolerable, or the voluntary resistance offered by the scles of the patient exceeds that at the command of the rator; a struggle is maintained between the patient's muscles l the surgeon or rubber, in which the latter is commonly not torious.

hrough the inability of one person to effect, with any effort his will, an extension forcible enough to overcome severe contraction, violent *sudden* extension, by means of the com strength of several assistants, or by means of powerful s brought suddenly into action, was proposed and carrie with varying success and misfortune, by Louvrier, Dieffe and others. In the less severe cases of deformity, those i which are curable by gentler means, without longer durat treatment, the parts were *suddenly* straightened by extension, without ultimately mischievous results, an expected benefit was obtained. But in severer cases of def of many years' existence, in which organic changes of magnitude had taken place, as in severe knee-anchylosi extensive suppuration about the articulation, with necros violent separation of adhesions, and snapping asunder of deposits in the popliteal space and elsewhere, were accom with laceration of blood-vessels and nerves, fractures bones themselves, and consequent inflammation, suppu and even mortification, of the member. The plan was des denounced, and fell into disuse.

Forcible extension under chloroform.—Surgery received valuable addition to its means of usefulness by the disco the anæsthetic properties of ether and chloroform; and pædic practitioners, following the example of Langen promptly availed themselves of the assistance these me calculated to render in the cure of deformities. Hen employment of forcible extension with the aid of chloro ether. By chloroformisation, the two great obstacles employment of force adequate to straighten or bend a con limb, namely, pain and voluntary muscular resistan removed. As soon as these impediments disappear, the of the single operator, and his single mind, applied to th encounter the physical resistance only of the deformed comparatively gentle manipulations now acquaint him nature and amount of difficulty; he can feel his way application of greater force; can feel and perceive the re of parts successfully overcome, in an anatomical order; if rigidity still oppose, a few movements of the joint backwa forwards prepare the way for a more extensive yieldin often the practitioner has the satisfaction of being able effect every natural movement of the joint.

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* *Commentatio de Contractura et Ankylosi Genu, nova methodo sionis ope sanandis.* Berolini, 1850.

oformisation, with manipulations, and the use of a cer- gree of force, may be of service as a means of diagnosis. he practitioner is enabled, in some degree, to ascertain roportion of the deformity is due to shortening of soft ow much mischief the articular surfaces have undergone, at amount of restoration is practicable.

straightening or bending the limb, as the case may quired, by means of this forcible procedure, the part be lightly secured in a retentive instrument or upon a a splint, adjusted so as to maintain a position more ble than that in which the limb was before the operation, not so as to keep it in the new position, *i.e.* the entirely or bent position into which the hands of the surgeon ve brought it. For as soon as the effect of the chloro- sappears, the patient arouses to the conviction of the which may have been employed, the part may be painful, and incapable of sustaining the pressure of a ndage or ligature.

usually content ourselves with the increased knowledge d of the nature of the case, with the satisfaction of g that the part can be improved in form and function, the resisting parts have once yielded, that they will rds oppose less resistance to replacement; whether the ubsequently employed should be simple manipulations, of mechanical apparatus, or repeated administrations of rm, and forcible extension. The surgeon who should the forcible binding down of a long-deformed limb ately after forcible extension, would betray a lamentable ce of the pathological condition of the parts in the ate vicinity and within the diseased articulation. h the muscular structures may have yielded under rm, and indurated fasciæ and old adhesions may have ercome by stretching and tearing, it will be remembered ch adaptation on the part of nerves, blood-vessels, and nts to the altered position of the structures, needs to be lished. We find that, by taking moderate means of g as much improvement after the forcible extension as borne by the sufferer, by the unsparing use of lotions of by ice applications, and by the internal use of morphia, us inflammation of joints thus straightened has been By employing afterwards the ordinary means of extension, we have straightened joints which would

disorder, i.e. removed the inflam
suppurating parts, or effected
tumefaction, the consequences of
and rigidity only remaining, he
internal and general therapeutic
tional state. This often slumbe
disease; and he should pause er
restoration of form and movemen
chloroform, or by other active m
evokes a renewal of local disorde

These views were enunciated*
perhaps with more leaning to the
sion. It will be found that viol
relatively small number of cases
suitably carried out. Orthopæd
contractions in which the innerva
(severe paralysis and spasm), an
surfaces, cartilages, and articula
not disorganised from disease.
more than straighten the limb,
knee contractions from articul
under chloroform is most opport
more useful position of the memb

The expectations of surgeons
likely to result from operative i

y forcible manipulation under chloroform, there is one rce available, that of severing the bone by subcutaneously ng or drilling it, below the trochanter, where it most nearly oaches the surface.

a few cases at the other extremity of the pathological , in which the will alone, or timidity, or the peculiar ab- nal state of the system exists which is met with occasion- in young persons of both sexes, in whom in consequence light injury, a limb remains stiff in the straight or bent tion (emotional or ideal paralysis), the part is relaxed under roformisation, and the contracture is often by this means mptly and permanently cured. True hysterical contractures d with equal facility during the anæsthetic state: but they ally return when the effect of the chloroform has passed off. ome of the severest hysterical cases which the author has with, recovery has taken place after the lapse of a few ths, or a year or two, either spontaneously, or from the ct of altered dietetic, social, or climatic influences.

W. J. LITTLE.

DISEASES of the bones may
the following classes :—*Fir*
sequences : under which head i
varieties of the inflammatory pro
names of periostitis, ostitis, and
sequences of these, all the num
been confounded together under
nation of caries, the various form
varieties of necrosis, its effects, a
which result in permanent modi
form of the organ. The *second* c
diseases, which occur either as m
tory process—syphilis, scrofula,
as constitutional conditions lead
structure ; such are, mollites os
The *third* division will comprise
new formations found in the osseo
dependent on any of the known c
fourth will treat of atrophy and h
i.e. uncomplicated by inflammatio

SIMPLE INFLAMMATION AN

Inflammation of bone differs fro

rences to ordinary observation, and have led to the designa- on of the results of inflammation in bone by names differing om those which are used for the same changes in soft parts. his difference in nomenclature, though it might arise in istake, at a time when necrosis was thought to be something sentially different from gangrene, and caries a disease which ad little in common with ulceration, is yet hardly to be regretted, ince the diseases of bone, though pathologically identical, are ractically very different from those of soft parts; and it is onvenient to have separate names for things which require ery different treatment, and entail a very different amount of anger.

If the reader will consult the appendix to the essay on INFLAMMATION at the end of this work, he will find abundant information on the early steps of that process. These affections are identical in bone and in soft parts; in fact, they can occur only in the soft parts of bones, since the mere inorganic matter, which, involved in the convolutions of a cellulo-fibrous and vascular network, constitutes a bone, can itself be the seat of no vital actions, but must obey the movements impressed upon it by the living textures around.

In Von Bibra's essay *On the Decomposition of Bone by Caries*,* will be found a good deal of interesting information on the chemical and microscopical characters of bone in inflammation; and from this author's researches it appears clear, that the changes in the inorganic constituents of bone are often limited to the dissolution of that connection which previously united them to the organic matrix, so as to form one system. This connection having been severed, portions of the salts are washed away in the discharges, and they may be found, according to Von Bibra's account, in unaltered chemical composition, while the composition of the organic constituents of the same part is profoundly changed, principally by that fatty degeneration which occurs in all inflammations. The inorganic constituents must, however, in some cases of inflammation undergo other changes, since they may disappear in large masses, without any discharge having been present. Thus in caries of the spine, or in inflammation excited by the pressure of tumours, it is not rare to find that large portions of the vertebral column

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* *Liebig und Wohler's Annalen*, vol. lvii. It will be found useful to compare this essay with those of Mr. Barwell and Dr. Black, referred to farther on.

fact of the disappearance of
discharge in which they can
clear that the small earthy
natural connection with the
reversal of the process by whic
fluid blood; *i.e.* may become
venous current.

The earliest microscopical cl
distinctness of all the vascular
sian canals, lacunæ, and can
marked than in the natural st
to the injected condition of soft
canals and lacunæ become w
consequence of the communic
and spaces are formed in the
salts, the detritus of the decom

The earliest change in the c
inflammation, appears to be s
the loosening and absorption o
liquefaction and conversion i
Mr. Barwell has published an i
which affords, perhaps, the mo
enlargement of the vascular sp
mation. In this essay, Mr. Ba
stages of inflammation are a
assertion which I venture to q
that induration is a phenomen

Such are the earliest changes in the minute structure and consistence of inflamed bone. The changes which take place in its rough anatomy may be thus described. If a bone be examined at an early period of inflammation (the ordinary and most accessible instance is the stump of the bone in an amputation fatal, say, three weeks after the operation),* the periosteum will be found somewhat thickened, vascular, and not so closely connected to the bone as usual.† If the periosteum be stripped off, the bone is seen to be irregularly vascular, some portions of it having a slightly red tint, and contrasting with the healthy white colour of the rest of the bone. This red tint is evidently caused by the enlargement of the vessels which pass from the periosteum into the bone; and if a magnifying-glass be used, the increased size of the vascular apertures is easily proved, while if pressure be made on the surface of the bone, drops of blood will frequently ooze from the mouths of the enlarged vessels, proving their increase in size, as well as the loss of consistence in the outer hard wall of the bone. At the same time there will be found, in all probability, on some other part of the surface, more or less deposit of osseous matter, which, with the partial separation of the periosteum above mentioned, testifies to the fact of effusion from the vessels of that membrane. In these simple cases of injury the deeper parts of the bone will probably be unaffected; but should this not be the case, *i.e.* should inflammation have also attacked the membrane lining the medullary cavity and cancelli, that membrane will be found in a condition essentially analogous to that of the periosteum, although the different situation of the medullary membrane, and the great quantity of fat and other loose tissues among which its vessels run, will somewhat modify the external appearances. If, however, these appearances be minutely investigated, they will be reduced to, increase in the number and size of the vessels, and effusion of blood, lymph, or pus, according to circumstances. The thickening both of the perios-

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[*] In such a specimen the periosteum will generally be found stripped off from a small ring at the lower end of the bone, and this part will perhaps be dead or about to die; but as this feature is accidental, it will not be further noticed.

[†] Hunter has put up (Mus. Coll. of Surg. No. 656) 'A preparation of a femur, which was amputated, with the periosteum separated; to show how clear the periosteum separates from the bones in inflammation; a fact almost always observable after amputation.'

endosteal, its primary sym
perhaps number) of the capi
effusion of blood or lymph.
tion in the central parts of
the above; though here, fr
which the vessels are pla
distinctly perceived; and
changes go on in the compac
of comparing the different
other. The first change is th
run in the Haversian canal
phenomenon, and is precede
tissue which adjoins the en
scopical sections of inflame
seen much enlarged, irregula
or quite, communicating wit
also be noticed to be densely
the granular matrix of the
natural. When this absorpti
canals becomes visible to the
rough anatomy of inflamed co
—that in which spaces are s
cancellous tissue, so that it
cellous. Similar changes occ
whereby its cells become m
whole bone is expanded by

one, or on its surface, by the removal of the earthy matter, the products of inflammation are next secreted. These secretions vary, of course, according to numerous preceding circumstances, e.g. the nature of the injury, or other cause of inflammation, the activity of the process, the constitutional condition of the patient, and a thousand others; and so the products of ostitis are divisible into two principal varieties, corresponding to the plastic and aplastic lymph met with in other parts, and leading, the former to the deposition of earthy matter and the formation of new bone, and the latter to suppuration. The former result terminates in hardening, or *sclerosis*, as it is termed; the latter in a variety of conditions: when the suppuration is limited within a cavity in the cancellous tissue, or in the compact tissue rarefied by previous inflammation, *circumscribed abscess* is produced; when the pus extends along the inner surface of the membrane lining the medullary cavity and cancelli, the condition of bone exists which is now usually spoken of as '*osteo-myelitis*,' and which used to be called 'diffused suppuration in bone;' suppuration between the periosteum and bone forms *periosteal abscess*, acute or chronic; and any of these forms of suppuration, when accompanied by the insensible exfoliation of the bone (or its death, and removal in invisible portions), constitutes ulceration of the bone, or *caries*. Lastly, inflammation of the bone sometimes leads to the death of larger portions of its tissue, which are then removed by the process of ulceration, as in soft parts. This constitutes gangrene of bone, or *necrosis*; but as that condition, like other forms of gangrene, is often produced by other causes not inflammatory, the whole subject of necrosis must be treated by itself.

We have now to consider separately the causes, symptoms, and treatment of each of these phases of the inflammatory process; the above being intended only as a kind of ground plan, to mark out the various parts of a rather intricate subject, each of which must be studied in detail.

Ostitis.—Inflammation of bone is excited usually by external violence, or exposure to cold, acting upon a constitution predisposed to the disease. The chief predisposing causes are, the syphilitic or scrofulous taint, rheumatism, and defective nutrition; or these may themselves set up inflammation in any bone, without a distinct exciting cause. From this mode of causation it follows, that the bones most liable to inflammation are those

habit of looking for it ; and pa
first obscure, and liable to be
the soft parts with which it
tional affection from which it s

The symptoms vary accordin
tion. In the first stage, that i
increased, and in which abs
disease frequently makes cons
ciable symptoms.* Sooner or
those characteristic dull pain
changes of weather, increasin
and somewhat resembling the
described by French writers as
attention of the patient to th
valuable guide to the surgeon.
the probability is that some ev
tion in the tissues surroundin
the skin, tenderness of the so
The absorption of the earthy
increased vascularity, manifes
diminution in its consistence
the same time increased in vo
tance to pressure. The form
delusive, since the apparent in
enlargement of the soft par
joint-ends of bones, which fre

luable indication of the disease. The softening is not nerally of much importance as a diagnostic symptom; it rely affects the whole thickness of a bone, so as to lead to a ange in its form, and, when limited to a portion of the surface, nnot be appreciated by the touch, since the inflamed and irrible condition of the soft parts renders the patient unable to ar the necessary pressure.

A singular change, which sometimes follows inflammation of a long bone, is elongation. Dr. Humphry has laid much stress upon the consequences of eased conditions of the epiphysial lines near the ends of long bones, as affecting eir subsequent growth.[*] It is possible that inflammation of this tissue may ve led to the elongation of the bone in some of the cases; as in a tibia from lad aged eighteen, preserved in the Museum of St. Bartholomew's Hospital, n which the bone has become lengthened, and is curved in order to adapt its ngth to that of the healthy fibula.

To the stage of absorption and rarefaction succeeds that of ffusion and deposit, unless the process be arrested, and resolution occur. The various consequences of suppuration enumerated on p. 735 being reserved for subsequent sections, we need now only consider that termination of inflammation of bone in hardening or sclerosis, which corresponds to the inflammatory solidification of parenchymatous organs; and which, when not too extensive, is for practical purposes little less desirable than complete restoration to health. The interstices of the cancellous tissue are filled up at first with lymph, in which ossific matter is afterwards deposited;[†] and then the bone, which, while actively inflamed, had been less dense than in its healthy condition, as in Fig. 184, becomes hard, heavy, and solid, as in Fig. 185; the medullary canal is narrowed or filled up, and the shaft thickened by deposit from the periosteum. Bones thus affected abound in every pathological collection; and it is easy to trace in them many of the appearances of which an explanation has been attempted above—the large size of

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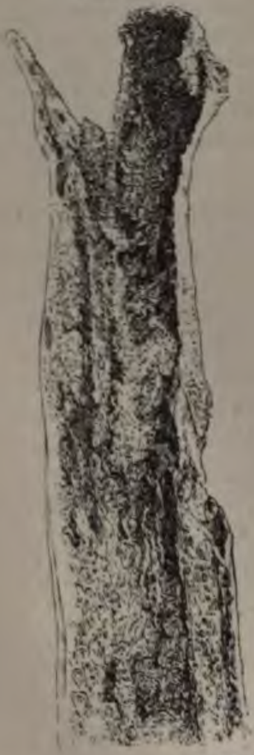
[*] *Med.-Chir. Trans.* vol. xlv. p. 294.

[†] An instructive case is related by Mr. T. Smith, in *Path. Soc. Trans.* vol. xviii. p. 218, of an amputation in a case of chronic ostitis of the femur. 'The shaft of the femur was somewhat enlarged, but its texture was greatly condensed and indurated. The cancellous tissue of the lower end of the bone was plentifully infiltrated with lymph in various stages of disintegration, being apparently purulent about the epiphysial line. This lymph was especially abundant towards the articular end of the bone, where it extended up to and beneath the articular cartilage, which latter was in parts removed by ulceration.'

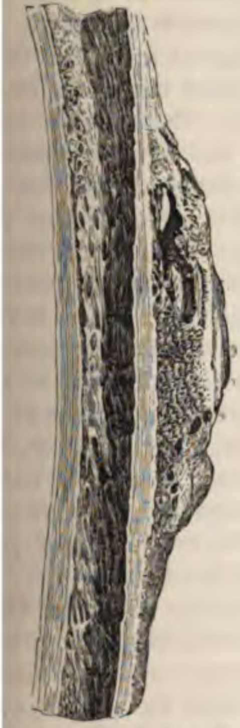
Fig. 184.



(From a preparation in the Museum of the Royal College of Surgeons, No.

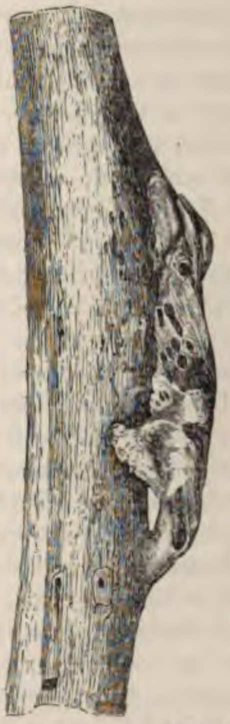
usually are unaffected, and the disease of the bones
ered by itself is not so extensive as to contra-indicate
n. To each of these two general rules, however, nume-
ceptions will, unfortunately, be met with in practice.
mmation of the bone is almost always known, in common
ce (when it is recognised at all), as *periostitis*; but in
periostitis seldom occurs uncomplicated, unless in the

Fig. 186.



riostitis. (External view.)

Fig. 187.



Periostitis. (Internal view.)

ings from a preparation in St. George's Hospital Museum, to illustrate the ordinary anatomy of periostitis.

of secondary syphilis; * and almost all the cases which
nder that name are really inflammations, more or less
ve, of the bone. That this is so, will hardly be doubted
one who considers how few preparations of pure perios-
n be found in our museums, and how seldom, during our

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ould refer the reader to the section on Syphilis in Bone for further
n the subject of chronic periostitis.

post-mortem examinations, we meet with periostitis
by inflammatory deposit in the deeper parts of the
symptoms, as well as the morbid anatomy, of both a
only that in periostitis the thickening and vascular
no other part of the nutrient membrane of the bone
periosteum, and that the inflammatory deposit is con
surface of the bone, between it and the periosteum.
is a quicker process, and one more under the i
remedies than the other forms of inflammation of b
all the same general course of treatment is indicat
internal administration of iodide of potassium, an
application either of iodine or mercurial ointment
early stage of the disease, of blisters. These meas
be combined with proper position of the affected m
as much rest as is consistent with attention to
health. Leeches or cupping will afford relief if t
severe. When there is much tension over the bone
accompanied (especially in the cranium) with intol
nothing gives such immediate and decided relief a
bold incision down to the bone. The distended pe
thus relaxed; and in cases of pure periostitis such
may of itself almost suffice for the cure of the disea
beneficial effects will be decided, though less striki
of deeper-seated inflammation. In cases of chroni
tion of bone, accompanied by deep-seated and weari
opening made with a trephine, for the evacuation
proved beneficial, even though no pus was found.*

Whether the sclerosis, or induration, which i
result of chronic inflammation, be amenable to a
measures is doubtful, since it usually gives the p
inconvenience, and therefore is not made the subje
ment. Thickening over the bone is often left after
is often dispersed by the ordinary measures, such as
pressure; but the seat of this thickening is very gen
soft parts around the bone, and not beneath the pe

Diffuse periostitis.—Inflammation of the bony tis
rarely acute, and when it does occur in the acute

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* See a case reported by Sir B. Brodie, in his *Lectures on Patholo*
p. 410. On the good effects of a free incision of inflamed pe
milder measures fail, see Sir P. Crampton 'On Periostitis,' *D*
Reports, vol. i. p. 331.

dly into necrosis, under which head it will be presently
ken of; but acute inflammation between the bone and
osteum, *diffuse periostitis*, is a disease of rather frequent
rrence, and is less noticed in surgical works than its im-
tance would seem to require. It is seen commonly enough
ersons about the age of puberty; more frequently in boys
n in girls; usually as the result of some injury, and almost
ays in one of the long bones. It is so destructive in its
cts, so rapid in its course, and is so little recognised, that we
re unfortunately numerous opportunities of verifying its ex-
ence after the time for treatment has passed away; yet to
ly and vigorous treatment it is tolerably amenable, at least
amenable as so acute a disease can be expected to be.

The pathology of the disease appears to consist in the partial
aration of the periosteum from the bone, by effusion on the
face of the latter of lymph, or other products,* soon giving
ce to a copious formation of pus, which spreads along the
ole bone, and dissects away the periosteum from it, ofte
m one end of the bone to the other. If examined at an
ly period of the disease, the periosteum does not (at least it
y often does not) display any distinct signs of inflammation,
her in change of colour or of thickness; nor is the surface of
bone visibly inflamed. On the contrary, it usually looks
ite, and inclined to gangrene, a consummation which rapidly
pends over such cases. Sometimes, however, the surface of
bone may be found slightly worm-eaten, and on squeezing it,
superficial layers are found more readily separable from the
per tissue than in health; large drops of blood can in such

The disease does not commence by the formation of abscess; often when
swelling and inflammation are considerable, no pus will be found. Of this
the following is an instance. A lad was suffering from what was supposed
e diffuse cellular inflammation around the ankle after a slight injury. As
as suspected that the inflammation was really subperiosteal, an incision
made down to the tibia. No pus followed. Two days afterwards the boy
ented obvious symptoms of confined matter, and now by breaking up the
esions of the wound a copious evacuation of pus was obtained, and the
ace of the bone was felt exposed. A few days later, swelling and tender-
were found over a higher part of the tibia. Thinking that on the former
sion I might not have divided the periosteum freely enough, I now took care
ress the edge of the knife firmly against the bone for some distance. Matters
t on exactly as in the former wound. No pus was found at the time, but
breaking down adhesions, two days later, with a probe, the pus was dis-
rged, and bone felt exposed.

fore-arm, evidently depending on the
perceived on rotating the hand, tog
to the belief that fracture had occ
was discovered that a periosteal absc
into the wrist-joint, had so eroded th
sensation of crepitus.

The course of the disease is
in the great majority of case
severity, occurring to a perso
stitution, at any rate a weak
immediately follow the injury
the occurrence of the accide
then, after a varying lapse of
symptoms occur which are al
to diffuse cellular inflammati
rigors, pain in the part, and
At the outset the diagnosis is
tion has occurred, perhaps no
However, as respects diffuse
the patient, the comparative r
previous immunity of the sup
picion of the nature of the
when the inflammation is see
the member first affected, in
spreading up the limb, as an
all likelihood do, and will be
discovery of deep-seated mat

e rheumatism will depend upon the nature and history of disease, and on the presence or absence of constitutional ptoms of rheumatism, or rheumatic affections of remote ts. At the outset of the case the diagnosis may not be y confident; but the main point to recollect is, that any iosteal affection, if acute, is liable to run early into suppuion, and that in such cases, whatever view may be taken of origin of the disease, whether it is to be considered rheutic or otherwise, the local treatment is far more important n the constitutional. What Sir P. Crampton says of the ate periosteal whitlow applies with much greater force to ate periosteal affections of the larger bones: 'there are few seases where art can do so much and nature so little.'

If the disease be allowed to go on unchecked, the whole cirmference of the limb will become greatly swollen and œdemaus, usually with that tense glistening aspect which tells of bjacent suppuration. The patient mostly complains of great in, especially acute at night; he loses appetite and flesh pidly. Pyæmia is very liable to occur, and many of these atients die of it. A few die exhausted by the violence of the ction, and by the profuse suppuration. If the patient survive, nd the abscess do not obtain a free and depending opening by imely incisions, it will burrow among the muscles, and ultinately numerous openings will form, exposing necrosed bone. The dead bone appears to separate much sooner than in other forms of necrosis, and the repair to be proportionally active. Thus, in an adult, almost the entire length of the shaft of the ulna was thrown off and removed three months after the injury which led to the complaint; and, even at that date, the repair appeared to be far advanced. In less acute cases, where only a portion of the surface of a bone is involved, the disease pursues the ordinary course of necrosis.

The subjects of this affection are almost always young persons,* in whom the strumous diathesis is well pronounced; but it occurs more rarely in healthy subjects about the age of

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* Chassaignac says, that out of eleven cases, only one had passed the seventeenth year, and was below twenty-one; and one was only eleven months old. In the *Path. Soc. Trans.* vol. vi. p. 284, a well-marked instance is recorded at the age of eleven days. A circumstance which seems to testify to the effect of a constitutional predisposition is mentioned by Chassaignac, viz. that in some cases several acute periosteal abscesses have been present in the same subject.—*Mém. de la Soc. de Chir.* vol. iv. pp. 286–7.

so fatal. But reference has
which the bones of the fore-
long bones may be the seat
is so. The flat and irregul
but Sir P. Crampton's case*
abscess formed beneath the
and cranium on both sides.
periosteal abscess of the ster
Trans. vol. xv. p. 181, and
probably of the same nature,

The treatment of acute per
greatest importance, as it is
rapid and dangerous an affecti
measures, the first and most
sufficient incisions into the sw
nature of the swelling, or as
will be settled by the groove
found, it is better in any case
where the pain is great, to m
in the part to which such pai
be advisable to administer c
examination when the affectio

Periostitis sometimes occu
by rapid swelling around th
of aching pain, but without t
which accompany the graver

ed on general principles; no special internal treatment is ssary for the affection of the bone. The indications are, lay pain, to support the strength, and to avoid, if possible, onstitutional affection which leads to pyæmia. The last is nost important of all; patients seldom die of the 'surgical ,' so called, which is usually present; they seldom die of the ustion of the discharge; but they die by pyæmia in a large ntage of the cases. How great the mortality is, it would fficult to say, since the disease is not generally recognised r hospital nomenclature; but out of a comparatively small ber of cases which have occurred during the last few years e surgical wards of St. George's Hospital, a very large ortion have died of pyæmia. Free and early incisions give atient the best chance of escaping this fatal complication. ar need be entertained of decomposition of the pus from dmission of air. In fact, pus which is confined over a bone n acute inflammatory disease, will probably be already iently putrid. The openings should at first be made in as nding a position as possible, and they should be so free as eclude all risk of their closing again. After the opening e abscess, free stimulation is generally, if not always, sary. The patient will, perhaps, be unable at first to take nourishment, since these affections are generally attended severe fever; but as soon as the evacuation of the matter removed some part of the irritation, his appetite will bly return.

abscesses which are at once deeply seated and small, it sometimes be advisable to use a drainage-tube; but in cases the collection of matter is too extensive to allow of treatment being beneficially adopted, at any rate till a period of the case, when the abscess is contracting and ncisions show a tendency to close. In the memoir of hassaignac, already referred to, the author speaks highly of dvantage of injections of very dilute hydrochloric acid, h have the effect, according to him, not only of cleansing uppurating cavity, but also of hastening the removal of ficial exfoliations by dissolving the dead bone.

the patient has survived the acute stage of the disease, the ss may long remain in a chronic condition, exposing the In the more favourable cases, the outer shell only of the has perished; while in the most severe, the entire shaft, ated from the epiphyses, may come away in a mass; or

cancellous tissue, an affectio
have given the name of ‘os
recognised in post-mortem ex
the patient. The more acute
affection are closely allied to
any rate very frequently, follo
bears the same relation to the
just spoken of does to the pe
character between the perioste
latter being so much more ri
patulous venous channels, give
beyond that of diffuse periosti
diffuse suppuration is found i
scalp-wounds, and how the ‘p
only the sign of such suppurat
percentage of such cases evid
bable that in all these cases t
been wounded, and the diploë
known cause of osteo-myeliti
cancellous interior,* or an in
perhaps unaccompanied by ex
is a frequent cause of death aft
operations in which bone is di

When a bone is examined i
acute course, the cancelli are
medullary tissue usually injecte

Specimens to show either of these terminations are not wanting in our hological collections. Thus, in the Museum of St. Bartholomew's Hospital re is a beautiful specimen[*] of inflamed and thickened medullary membrane the humerus, which shows, as a consequence of the inflammation, a portion cancellous tissue exfoliated and lying loose in the medullary canal. A long ula leads through the tube of the bone into the elbow-joint. The same seum possesses another specimen,[†] in which acute diffused suppuration, reading through the tissue of many of the long bones, has caused abscess in e knees and ankles on both sides.

The symptoms of this grave affection are exceedingly obscure: , like other extensive and acute affections of bones, is often acmpanied by diffuse inflammation of the soft parts, which then asks the deeper affection. Rigors and general fever always ark the onset of acute osteo-myelitis, but the only known pecial symptom of the disease in the bone is the separation or ecession of the periosteum from it, accompanying diffused pain n the bone, and not caused by effusion on the external surface f the latter. After amputations, a prominent fungous mass is ften seen projecting from the end of the bone, and proves the xistence of a certain extent of inflammation of the medullary tissue; but this need not necessarily have affected the bone so extensively as to deserve the name of osteo-myelitis; in fact, that affection is seldom recognised before death.[‡]

To obviate the formidable dangers, and the extensive disintegration of parts connected with osteo-myelitis, it is justifiable in any case where pain in the bone, accompanied with the ordinary symptoms of acute suppuration (rigors, fever, &c.), but without signs of external or periosteal mischief, induces a reasonable suspicion of this affection, to expose the surface of the bone by a free incision. Should the periosteum be found separated, or even separating, from the bone, the diagnosis of

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[*] Series i. No. 207.

[†] Ibid. No. 195. See also No. 104, a preparation in which the whole of the inner portion of the os calcis is separating from its outer wall, as a consequence of diffused suppuration through its cancelli.

[‡] If after an amputation acute osteo-myelitis be suspected, the surgeon can establish his diagnosis by putting the patient under chloroform, and ascertaining by means of the probe that the whole medullary tissue is broken up for a considerable distance, as well as the small portion which is projecting out of the wound. See Fayrer, in *Indian Annals of Med. Science*, Oct. 1865. 'The symptoms of acute osteo-myelitis are pain in the part, œdema, and swelling extending down the limb; general fever, with quick pulse, and increased temperature, and more especially the recession of the soft parts, including the periosteum, from the bone, which is then left denuded at the bottom of the wound.'—*St. George's Hospital Reports*, vol. i. p. 150.

principles. In deciding on the q
bone (an operation which would
contra-indicated if pyæmia had
how much the early symptoms
those of typhoid fever;* so tha
cases to give the patient the be
to relieve him from the source o

In chronic osteo-myelitis the r
successful in affording the patie
of irritation, which will at len
when this affection is limited to
expectant treatment is indicate
after the extraction of a sequest

Chronic abscess.—Limited sup
cellous tissue, is an affection whi
recognised, and far more unde
osteo-myelitis. It hardly needs
bone was first discovered and de
symptoms are not always very c
case seldom fails to establish th
of the disease is almost always
bones which form one of the
elbow. The tibia is more freq
bone, and usually at its uppe

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wever, occur in any situation.* The abscess is almost always cated on the superficial side of the bone, and is probably sioned, in most cases, by external violence, or other causes, ting on that surface; but the history is often obscure, in conquence of the chronic nature and insidious progress of the lady. The disease is said to be more frequent in England an on the continent of Europe.†

The symptoms are, a dull aching pain in the part, often orse at night than during the day, liable also to other remisons and exacerbations, and increased by exercise or pressure. n most cases the bone is especially tender at one particular ot, where the abscess has advanced nearest to the surface, nd there is slight tumefaction of the soft parts over it. Somemes, but not always, a little enlargement of the bone itself ay be made out. There is perhaps nothing very characeristic in these symptoms taken separately, or on a first exmination; but the persistence of the whole assemblage of hem for a considerable period of time, and in spite of judiious treatment, directed to subdue an inflamed condition of he bone, will be reasonable ground for the diagnosis of chronic bscess, and more especially if the neighbouring joint be unffected. The localised, and very circumscribed, tenderness is erhaps, when well marked, the most unmistakable symptom.

The condition of the diseased bone testifies very clearly to he nature of the morbid process, so that few museums are ithout some of these preparations. The following is Sir B. rodie's description of the first preparation which he disected:‡ 'The lower end of the tibia is enlarged, and the surace presents marks of great vascularity. The bone in the reparation is divided longitudinally, and just above the articuating surface there is a cavity as large as a small chestnut. his cavity was filled with dark-coloured pus. The inner surace of it is smooth. The bone immediately surrounding it is harder than natural.'

If the case be allowed to proceed beyond this stage, serious and frequently fatal mischief may ensue from the extension of the abscess into the neighbouring joint. Before this event

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* In the Museum of St. Thomas's Hospital there are examples in the body of a rib, in the clavicle, and sternum. Series C. Nos. 84, 84¹, 85.

† Mr. A. Bruce, in *Med. Times and Gazette*, 1868, vol. i. p. 297.

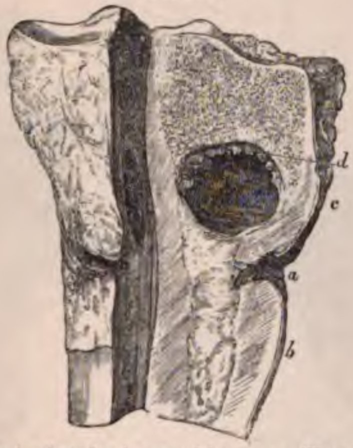
‡ Op. cit. p. 397. The original preparation is in the Museum of St. George's Hospital, series ii. 30.

affection of the bone becomes
to the articulation.

Treatment.—In all cases, as
far settled as to satisfy the su
is justifiable, he ought to expl
patient, and endeavour to obta
tion which will at once establis
ease. There is not generally
consent of the patient, who
enforced inactivity have render
Chloroform should be administ
bone well exposed by a crucial
be perforated to a considerab
which should not have a shou
of the bone appears softer tha
for the centre of the openin
welling up in the groove, as s
the compact wall of the bon
withdrawn, and on the circl
elevator, the pus will be ev
lined with a thick 'pyogeni
very sensitive. The pus is
about a tea-spoonful);* but
relieve the patient of his wea
to perfect health, the cavity
material, by which in all pro
reproduced.

t quite the right one; or the diagnosis may have been rong, and the symptoms have depended merely on chronic titis. In the latter case, as may be seen by Sir B. Brodie's tient above referred to (p. 740 note), the operation will often good, will relieve the pain of the inflammation, and perhaps rove the starting-point of a healthier action. It is well, hower, remembering that this mistake has been committed by e best surgeons, to prepare the patient for it, so that he may ot be too much disappointed if the surgeon shall afterwards

Fig. 188.

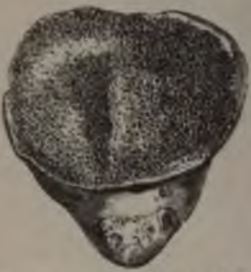


Unsuccessful trephining in chronic abscess of bone. *a.* The point where the trephine has been applied about half an inch from the abscess. *b.* The wall of the bone, thickened by inflammation. *c.* The cavity of the abscess. *d.* The pyogenic membrane. (From a preparation in St. George's Hospital Museum. Series ii. No. 31.)

ave to confess that no pus was found. If, however, the trephine o not come down upon an abscess, it should not be forgotten hat this may depend on the opening having been made on one ide of the abscess, which may be lying close to the trephineole, but separated from it by a thin bony septum. This is llustrated by the accompanying drawing from a preparation in he Museum of St. George's Hospital. It is advisable, therefore, when the pus has been missed, before giving up the operation, to pierce the walls of the trephine-hole in several directions with a sharp-pointed instrument, in order to remove the bone freely with a chisel if a drop of pus follow any of these punctures.

Caries.—The word caries will be used in the sequel as equiva-

FIG. 189.



Simple ulceration of bone. (From a preparation (No. 607) in the Museum of the Royal College of Surgeons.)

former, although there is as m
ulceration and simple ulcerati

ters. The periosteum is loosened from the surface, and, if disease is advanced, will be found much thickened, and nverted into a villous mass of a pink colour, resembling a er of granulations. This substance adheres very loosely to e surface of the bone, and, when lifted up from it, it is found fit into depressions, which seem to have been hollowed out the bone by the agency of the granulations. The bone at a ry slight depth underneath is found, in most cases of healthy flammation, of the ordinary consistence of cancellous tissue, hich it resembles in structure even in those parts which ought be compact. In strumous caries, on the contrary, the osseous ructure will be found softened and otherwise altered, as will e described when treating of struma in bone; and it is to is combination of strumous inflammation of the body of a one with ulceration of its surface, that the old descriptions of aries appear to be intended to apply. The ulcerated surface in ealthy inflammation is superficially excavated, much softened, nd easily broken down by the pressure of a probe. The nterior of carious bone is softened by inflammation, its cancelli nlarged, and filled with the products of the softening and isintegration which have been going on around them. These products, as has been noticed above, are principally oil-globules, blood, and other débris of the soft tissues, and granular inorganic materials, having the same chemical composition as the salts of the bone. The soft tissues almost always take part in the morbid actions which lead to caries, and abscesses are formed which burst externally, and leave sinuses communicating more or less directly with the softened bone, and through which some part of its exposed surface can generally be felt with the probe. Abscesses, however, frequently form in the neighbourhood of inflamed bones without any actual communication with them. This is, perhaps, more peculiarly the case in childhood, and near the joints.

Symptoms.—The symptoms of caries are merely those of inflammation *plus* an abscess exposing softened bone; hence all that has been said about the frequent obscurity of the early stages of ostitis will apply to caries, and with greater force, inasmuch as these ulcerative actions are more prone to occur in the course of low inflammations. Constant pain, then, in the neighbourhood of a bone, with swelling and more or less loss of the function of the part, followed by abscess which will not heal, indicate usually that the abscess proceeds from ulceration of a es, however, of ulceration are met with, in which the disease more deeply seated, and commences in inflammation of the mbrane lining the cancelli or medullary cavity, and where, refore, the agents for the removal of the bone are to be ght in the vessels of this membrane. Such cases as these very rare. I am able to refer to preparations showing the lity of the affection,* but I have no knowledge of the special nptoms which it presents, or the indications, if any, which it nishes. It is evident that, shut up as the inflamed parts are the interior of the bone, the products of inflammation can d no exit, and the disease must soon become merged in one volving more extensive destruction, *i.e.* in diffused suppuration internal necrosis.

A question is very frequently asked as to whether caries or eration in bone be a curable affection or not. To this only e answer can be given: viz. that no ulcerative, *i.e.* destructive, ocess is ever curable, in the widest sense of that term, since me defect will always remain; but that ulceration in bone, e ulceration in soft parts, may terminate in cicatrisation, or e reproduction of an inferior kind of bone which is less vas- lar, and less smooth and well formed than the portion which replaces. This fortunate termination becomes less probable, e deeper the disintegration of the bone extends, and the more ofound is the constitutional cachexia with which it is asso- ted. In extensive strumous caries it is hopeless.

The *treatment* of bone affected with this form of inflammation a matter of great importance; since upon the success or ilure of such treatment, the preservation of the bone, and with sometimes of the limb, or even the life of the patient, may pend. Ulceration in bone does not differ materially from the me process in soft parts, except in the far greater length of e which it usually occupies. In the bone, as in soft parts, powers of nature will in most cases suffice for cure, when e is possible, if the parts be put in a suitable position, kept rest, and preserved clean and free from the accumulation of discharges. But often the patient cannot wait for the npletion of this natural process, and calls upon the surgeon deliver him from the chronic malady which has become in- portable. Or, sometimes his health gives way under the otracted discharge; or, after an interval of quiescence, the

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* St. Bartholomew's Hospital Museum, series i. No. 163.

necessary to keep the discharge free, or
beyond this limit. In fact, in all the
much benefit appears to follow the mer
structures over the bone. When the sur
and carious, it is still more necessary to
since otherwise, the pus, being confined
the periosteum, and extend the mischie
parts of the bone.*

Often after this free exposure of the c
will gradually subside; but when thi
question occurs, whether it will be prop
the carious surface and expose a more
rasping or gouging the bone, or by
actual cautery; or to modify the diseas
or by applications to the carious part.
are in use are composed either of iodine
The latter is intended to unite with the
salts of the bone, and thus to remove its
ing successive portions of it. It has bee
recommended by M. Chassaignac; † an
to exist to its employment in suitable c
that I have found much benefit from its
tincture of iodine in the treatment of
disease of inaccessible portions of bone (
abscess), has been warmly extolled

obert, who has tested the practice by numerous trials, pro- ices (what indeed theoretical reasoning would have led us to ct) that M. Boinet 'has singularly over-estimated the good ts of iodine,'* and from the few trials that I have had the rtunity of making, I believe that M. Robert's estimate of treatment is very near the truth. The iodine may be used ted at first, with one or two parts of water; and afterwards pure tincture (Lond. Phar.) may be used. It is better at to withdraw as much of the injection as will run out, and r the opening with a poultice. Numerous injections will ecessary.

cases of superficial caries of bones which can be exposed out too much injury to the soft parts (of which the tibia calcaneum are the most familiar examples), it may some- s be advisable to rasp or gouge away the carious surface e bone, and endeavour to arrest the further progress of the se by the application of the actual cautery or strong ic acid to the surface so exposed; or, if the disease be very rficial, the latter measures may be sufficient, without any minary removal of bone.

r. Pollock has employed the application to the carious face of sulphuric acid, at first diluted with an equal bulk water, and then more and more nearly pure, pencilled on the face when exposed by turning away the soft parts. The st application dissolves a portion of the exposed bone, and rs and kills the rest of the surface; when this comes away, more dead or diseased bone is exposed, it can be similarly eated until a healthy granulating surface is reached. In is way also superficial exfoliations of necrosed bone can be moved. I have witnessed the success of this plan in the ands of my colleague, and can speak also favourably of it om my personal experience.

Another plan, which is applicable also to the treatment of ries in more deeply-seated bones, has been proposed by Dr. itzpatrick.† He converts the sinuses leading down on to a iseased bone, into a large funnel-shaped opening, by the peated action of the Vienna paste (potassa cum calce), and aving thus brought the diseased bone within reach, he pierces s tissue with a strong knife, trocar, or small trephine, and then freely cauterises the full extent of the perforation. The cauterisation is to be repeated till the whole extent of the disease seems to be removed, and the use of the limb is restored. Necrosis can, according to Dr. Fitzpatrick, be treated in the same way: 'the caustic being very freely used, destroying all foul undermined integument, and leaving large clean circular openings, more than an inch in diameter, and extending deeply down into the sequestrum, into contact with which the caustic in stick and powder is to be freely brought.' He recommends it also in simple inflammation (a recommendation in which I cannot say that I concur); but not in diffused suppuration. My personal experience of this treatment has been limited, and in one case which seemed peculiarly well suited for the treatment, and where the disease, which was seated in the ankle, was in a perfectly chronic state, the patient died of pyæmia.

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* Robert, *Conférences de Clinique chirurgicale*, p. 208. Paris, 1860.

† See *New Syd. Soc. Biennial Retrospect*, 1867–8, p. 259.

These operations should, however, only be performed in cases of evident necessity. We have only too frequent instances of the dangers of all operations on bone, especially of such as involve the exposure of large surfaces of the cancellous tissue, as is generally the case in these gouging or rasping proceedings, which are extremely apt to be followed by diffused inflammation of the interior of the bone (osteo-myelitis) and by pyæmia. Still, if the disease be accompanied with much pain and loss of motion, and the wound show no tendency to heal, the patient is often compelled to have something done for his cure, as otherwise he would lose his means of livelihood; or the surgeon may think it right to interfere in order to arrest the progress of the disease into neighbouring organs. The decision of such questions as these must, of course, be left to individual judgment.

The application of the actual or potential cautery appears to be less dangerous than cutting operations, and is often successful in superficial caries. It seems less in use than might be expected, considering the many cases of caries limited to one, and that a superficial, bone of the tarsus and metatarsus which are seen, especially in children. Here, however, and in all situations where a bone can be removed without prejudice to the function of the part, excision is so much more satisfactory when any large part of the bone is involved, that it is, perhaps, not wonderful that the less radical measures are not much in use.

M. Sédillot has proposed a more extensive use of the opera-
n of scooping or gouging carious bone, as a substitute for
cision or amputation.* His plan contemplates the removal,
the gouge, of the whole bone except a shell of the outer
althy parts, which is left to effect the restoration of the
ne. With all due respect for the authority of M. Sédillot,
seems impossible to allow that such a proposal is either
eful or safe. There are few cases of extensive and deep-
ated caries in which the limits of the disease can be ascer-
ined, and a partial operation is often worse than none at all.
sides, extensive exposure of the interior of a bone is a most
zardous proceeding, and only too often terminates in pyæmia.
. Sédillot, however, is said to have performed his operation
irteen times without any instance of such complication. The
rther consideration of this question will occupy a portion of
e essay on EXCISIONS.

Ulceration in bone is not always of this chronic nature. Mr.
Stanley has described† some cases of 'phagedænic ulceration'
f bone which seem to have been connected with the occurrence
f rodent or cancroid ulcer‡ in the soft parts; and in diseases
ore distinctly partaking of the nature of cancer the bones may
destroyed with great rapidity; but here the affection in the
nes is only a part of the general disease, and its treatment
st depend on the view which may be taken of the latter.
es of rapidly spreading ulceration do, however, occur, in
ch the bone alone is affected.

vo remarkable instances have been put on record by Mr. Cæsar Hawkins;§
e of which the disease was only part of a general strumous affection, but
iar on account of its extreme rapidity and great extent. The other was a
remarkable instance of removal, by disease, of great part of the skull-cap, and
usion of the brain through the opening so left; but without the formation of
An abscess was found in the brain, but this was connected with violence
to the protruded portion of that organ, and not with the disease in the
- No distinct proof of the presence of any constitutional cachexia was
ned, nor was the exciting cause of the complaint apparent. Its inflam-
ry nature was testified by distinct marks both of inflammatory thickening
f inflammatory erosion on the bone in the neighbourhood. Therefore the
efinition of ulceration as 'absorption from inflammation' would strictly
to this extraordinary case; and we have already seen (see pp. 731, 2) that

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Lancet, Dec. 10, 1859. Sédillot, *Sur l'Évidement des Os.*

On *Diseases of the Bones*, p. 65. ‡ See vol. i. p. 196.

Med.-Chir. Trans. vol. xxxix. p. 285.

the formation of pus, though an ordinary, is not an absolutely necessar feature in ulceration of bone ; but it is rarely indeed that so large a portio bone is removed without the formation of abscess, especially when comp tissue is involved; for the instances of removal of inflamed bone with suppuration, hitherto noted, have occurred almost exclusively in thick c cellous bones, such as the vertebræ and tarsus.

Necrosis, or the death of some considerable portion of a bon occurs as the consequence of any cause which sufficient impedes the circulation in the neighbourhood. This is pr cisely analogous to what takes place in the gangrene of s parts; and as in gangrene the non-vascular parts are mo easily affected, and then those which, though vascular, a furthest from the centre of the circulation, and in which th vessels are fewest and smallest, so the frequent occurrence necrosis of bone is, no doubt, due to the comparatively sma quantity of blood which circulates in that tissue, as well as the inextensible nature of the osseous substance itself, in cons quence of which any extravasation or product of inflammatio causes pressure directly upon the blood-vessels, or narrowing the channels for the conveyance of the nutritive plasma.

It is denied by some authors of reputation on this subject tha necrosis is ever a consequence of inflammation of bone,* an they refer the disease always to periostitis or osteo-myelitis a its cause. But this appears an error in two senses. In the first place, there is no essential difference between periostitis, or osteo-myelitis, and inflammation of bone. The diseases so called are only inflammations in which the part of bone alone affected, or, as is much more common, the part *most* affected, is the external table or the medullary tissue. In the second place, the disease properly called ostitis very frequently induces necrosis, not indeed usually of the inflamed part, but of the parts in its neighbourhood. The inflamed part itself does not usually perish, because the final cause of necrosis is the stoppage of the circulation by the obstruction or obliteration of the vascular channels, while the first effect of inflammation is the enlargement of those channels. When the ostitis has reached the stage of exudation, the dilated vascular channels become agai narrowed; but the process takes place slowly, and organis which involves the formation of new vessels, takes place in the exuded material as it is produced. Still, although the event i

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* Gerdy, *Maladies des Organes du Mouvement*, p. 217. 1855.

a common one, traces of inflammation are seen on sequestra
iciently often to show that the inflamed part does sometimes
. The same causes, in fact, which produce gangrene in soft
ts will occasion the death of a bone ; and among them inflam-
tion holds a high place, less on account of its direct effect,
its tendency to produce the death of the part inflamed, than
its indirect consequences, whereby the circulation around the
lamed part is obstructed, and so necrosis of the neighbouring
rts is induced. Hence in the course of an extensive caries
e circulation of some considerable portion of the bone is apt
be destroyed, and then a necrosed or loose piece is found in
e middle of the ulcerated part. Such combination of necrosis
ith caries was called by the old writers dry caries or hard
ries.

Another very frequent, if it be not the most common, cause
superficial necrosis is the denudation or separation of the
eriosteum, which occurs as a consequence either of direct
jury or of effusion between it and the bone. It is true that
rge separations, and even extensive destruction of the perios-
eum may occur without the death of any portion of the bone,
nd this is indeed common in the bones of the head and face ;
ut the peculiar circulation in the former, and the great vascu-
arity of all parts in the latter region, sufficiently explain this
act. In other parts, it is the more general rule that when the periosteum is destroyed or separated over any considerable portion of a bone, the superficial layers of the latter will perish. This is one reason, among many, why it is important to adjust the soft parts over a bone denuded by violence, in order that they may rapidly adhere to it, and that so fresh vessels may connect the periosteum to the bone before the latter has undergone an irremediable change.

Violence, acting directly upon the bone, is another very frequent cause of necrosis, as is frequently seen in compound fracture, where both the periosteum and the medullary tissue are much damaged, and the bone dies without any proof of previous inflammation having existed.

The action of cold is often exhibited on the bones as on the soft parts, and the subject will be found treated of under the head of Frost-Bite (vol. i. p. 169). In deep burns the bones are also occasionally charred, and they are frequently involved in gangrene of the superficial tissues, from whatever cause it arises. Certain caustic applications are well known as frequent causes of necrosis, of which the superficial exfoliation produced on the surface of the jaw for the cure of epulis is a familiar example. To this category belongs also the necrosis of the jaw which is produced by exposure to the fumes of phosphorus.* The various constitutional cachexiæ, especially syphilis and struma, are frequent causes of necrosis; but here the affection of the bones is only a variety of the inflammatory process.

The abuse, and even occasionally the moderate use, of mercury is another cause of necrosis. It is quite true that many of the preparations and cases entitled 'necrosis from the abuse of mercury' may be explained as having been cases of syphilitic necrosis, in which mercury had merely failed to arrest the disease, and had had nothing to do with causing it; but there are too many instances on record of the occurrence of necrosis of the jaw, during the administration of mercury for some disease which has no influence upon the bones, to admit of a doubt that the affection was directly induced by the so-called remedy. Thus, in the Museum of Guy's Hospital (No. 1,091) is a sequestrum consisting of two-thirds of the alveolar process of the lower jaw, which is said to be 'necrosis induced by the use of mercury for ovarian dropsy.' Unfortunately it appears that what is a moderate use of mercury in one person, is equivalent in rare cases of idiosyncrasy to an excessive abuse, so that no practical rule can be laid down; but it is at any rate proper to remember this occasional effect of mercury, particularly when prescribing it for cachectic persons. In the Museum of St. Bartholomew's Hospital is a preparation, in which necrosis of the jaw is attributed to the administration of a few grains of mercury during a fever; but in some fevers necrosis has been frequently observed as a consequence of mere lowering, as it would seem of the vital powers, without any mercurial cachexia.†

It would be idle to attempt an enumeration of all the causes which may lead to the death of bone. The above are the most common, and will be found sufficient for practice. The symptoms and treatment are identical in most of these forms. Some will require special notice hereafter.

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* This affection will be found treated of in the essay on SURGICAL DISEASES OF THE TEETH AND GUMS.

† See, in the Museum of St. George's Hospital, series ii. Nos. 91, 95, preparations in which both the jaw and the clavicle became necrosed in the same patient during the course of a fever.

When a portion of bone is to die,* the first phenomenon is cessation of circulation in it. This leaves it hard, white, d sonorous when struck. It does not bleed when exposed or into, and is insensible. Occasionally, when the dead bone exposed to the air, and acted on by the presence of putrid s, its colour becomes nearly or quite black; large surfaces of rd, black, necrosed bone are sometimes left exposed by the ughing of the skin over the tibia. The dead bone at first tains its connection to the bone around, as well as to the riosteum, or whatever part of the nutrient membrane may long to it; but the presence of a dead part is never long lerated by the living tissues, and accordingly the processes hich are to eliminate it soon become perceptible on both these ructures. The periosteum, or medullary membrane, as the se may be, separates from the dead bone and becomes inflamed, quantity of ossific deposit (more or less, according to various ircumstances) is poured out between it and the dead bone, and his deposit soon becomes converted into new bone, forming a heath over the dead portion, by which the latter is enclosed, r *invaginated*, as the technical term is. The dead part is now alled a *sequestrum*, a name only properly applied to it when oose and invaginated, though often incorrectly used of any piece of dead bone. While this sheath is being formed from the membrane coating the dead bone, changes are going on in the living bone to which it was attached. When the latter has been previously diseased (*i.e.* when the necrosis has been of inflammatory origin), the inflammatory deposit which surrounds the sequestrum softens, pus is formed, and a groove of ulceration is produced at the expense of the circle of inflamed bone which forms the margin of the sequestrum. If the surrounding bone have been previously healthy, the sequestrum acts as an irritant upon it, setting up, first inflammation and thickening to a variable distance, and then ulceration. Thus a groove is traced around the sequestrum; and the formation of this groove is accompanied by suppuration, as has been described above (see p. 735). The pus formed in the neighbourhood of the dead parts makes its way to the nearest surface, and in so doing interrupts the formation of the periosteal sheath, leaving sinuses, or *cloacæ*, passing through this sheath from the sequestrum to the surface of the body, or sometimes into a neighbouring joint or serous cavity. The presence of such sinuses, leading through the shell of bone to hard, smooth, sonorous bone at the bottom of the cavity, is the distinguishing mark of necrosis. Most of these points are illustrated by the accompanying figure.

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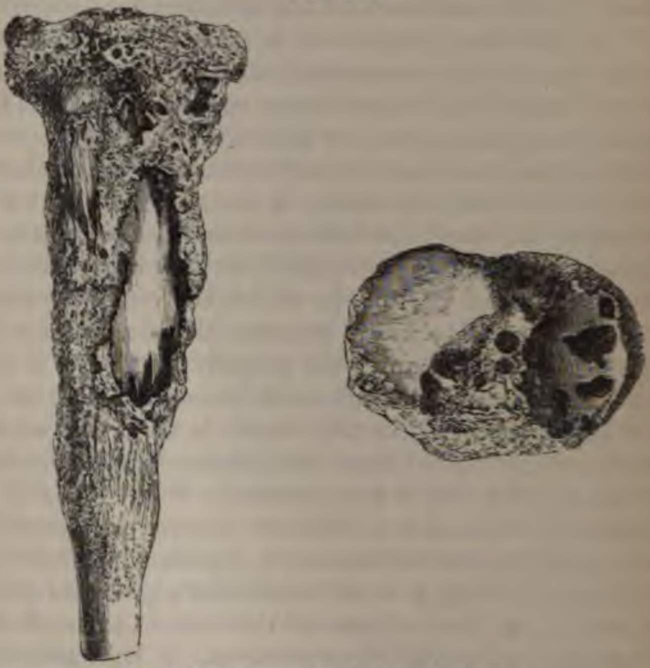
* This description refers to the process as it occurs in bone previously healthy.

The formation of the groove between the dead and living bone is a very slow process in the bones of the limbs, requiring generally many months for its completion. It is impossible to lay down any rule as to the time at which a sequestrum may be expected to be found separated from the rest of the bone. In animals, as has been proved by experiments,* the process may be completed in a few days. In children it seems to go on sometimes with great rapidity, especially in the bones of the

Fig. 191.



From a preparation (No. 3,174) of necrosis of the tibia, in the Museum of the Royal College of Surgeons. To show the various points connected with necrosis of a portion of the shaft of a long bone—the sequestrum—its invaginating sheath formed in a great measure by periosteal deposit, and terminating on the healthy surface of the bone, at some distance from the seat of disease, the openings or cloacæ, through which the sequestrum is exposed, and (in this instance) the implication of the neighbouring joint from the extension of these cloacæ into it.

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* Troja, *De novorum Ossium Regeneratione*, exp. i.

e. On the other hand, instances are not wanting in which f a lifetime may have elapsed, and the process still remain finished.

ne of these has furnished a preparation in the Museum of St. Bartholomew's spital.* It is the section of the shaft of a femur, exhibiting in its interior mall fistulous cavity, with necrosis of a small portion of the inner layers of wall. A groove extends to some depth between the dead and the con- uous living bone. The limb was removed by amputation. The femur had en fractured thirty-five years previous to the amputation; the fracture was llowed by abscess in the soft parts, and the formation of a fistulous passage ading to the interior of the bone, which passage remained open during the hole period from the fracture to the removal of the limb.

It may, however, be stated generally, that the more super- cial the dead portion is, the more freely it is exposed, and he more violent the action of the cause has been, the more apidly will it separate (see p. 743).

When the groove is completed, the dead bone is loose in the avity so formed for it, and quite free from any vital connection to the body. The sequestrum, therefore, is now eliminated, and this may be regarded as the natural process of cure, since it prevents the extension of the necrosis further into the bone; but as the sequestrum is still lodged in its cavity in the interior of the bone, it thus becomes an abiding source of life-long irritation, which must by all means be removed as speedily as possible.

The above is intended for a sketch of the process of necrosis in one of its most frequent seats, viz. the outer (subperiosteal) layers of the compact sheath of a long bone; but it may occur in any situation—in the medullary canal, or central layers of the compact tissue, in flat or irregular bones, or the spongy ends of long bones; or again, the extent of the necrosis, or the situation of the part, may modify considerably the process of separation, *i.e.* the surgical aspect of the case. For example, even when necrosis is subperiosteal, and the process of separation normal, it may be in a part from which extraction is impossible, as on the inner surface of the skull, spine, pelvis, thorax, &c. The subperiosteal sheath is often wanting in the bones of the limbs when the soft parts have been extensively destroyed over the affected bone; and it is never formed in the skull, where necrosis is so common, nor in the cancellous bones, where, though less common, the disease is by no means rare.

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* Series i. No. 176.

epiphysis.†

Each of these conditions is accom
liarities. When the whole thicknes
especially in a bone, like the humeru
motion, fracture is likely to follow
groove, although this result may be
of the case of new bone. When the w
the case assumes a graver aspect, sin
tion which is necessary for the forma
the great suppuration thereby produ
permanently abolishes, the functions
become matted together, the skin œ
by numerous sinuses, the parts belo
motion or energetic action; cases eve
inflammation, having reached the gr
coagulation of the blood in both art
quent dry gangrene of the limb.‡ I
ulceration around a sequestrum, or o
involves a large vessel, or the point of
bone is driven into the artery in some

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* Guy's Hospital Museum, No. 1160^{30}, necr
of the femur, and upper end of the tibia. Se
farther on.

† See a case in my work *On the Surgical Tr*

l thus either a direct wound of the artery is produced (when sinus of the diseased bone communicates with the laceration the artery), or if no opening exists externally, a consecutive eurism may possibly be established. In any case of such ury to the main vessels, when the diagnosis can be properly ablished, amputation would be indicated in the lower limb. the upper limb the main arteries are separated from the ne by a mass of soft parts ; and smaller vessels would hardly mplicate the case, as they might be included in the incisions quired to expose the diseased bone. In other situations tempts must be made to tie the ulcerated vessel; and if they il, as they generally will, from the rotten condition of the arts, the trunk leading to it must be secured by ligature or mpressure.

In cases of necrosis involving the whole thickness of a bone *otal* necrosis), when the seat of the disease is a large bone, uch as the femur, life is in considerable danger; and as the atients are usually persons in whom some constitutional achexia is present, and probably in an advanced stage, they requently succumb.* Still the dangers of amputation in these ases are so great, and the advantages of saving the limb so ecided, that they are usually left to the reparative powers of ature. In small bones, such as the phalanges, amputation is ndicated. In the upper limb large portions of the whole thickness of the shaft may be removed with entire success, and preservation of the motions of the extremity. In the essay on EXCISION, the indications for excision of the whole or parts of bones on account of necrosis, involving their whole thickness, will be further considered.

Central necrosis is usually an obscure complaint, and is hardly distinguishable by its symptoms from chronic abscess of the bone. In fact, as their symptoms are the same, so the same treatment is applicable to each of them. Deep-seated pain, throbbing, loss of rest, general debility, perhaps rigors

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artery in disease of the jaw, and from the aorta in caries of the spine. Mr. Stanley (op. cit. p. 111) relates a case in which the capsule of the knee joint was penetrated by the pointed end of the necrosed shaft of the femur.

* An interesting case of total necrosis of the shaft and upper part of the femur in a young subject, aged thirteen, in whom amputation was successfully performed a year and a half after the commencement of the disease, is recorded by Mr. Kerr of Aberdeen in the *Ed. Med. and Surg. Journ.* 1834, vol. xlii. p. 98. It is worth perusing, as showing the activity of repair at that early age.

Deep-seated necrosis often le
way to a free surface. This is
and is a frequent cause of absce
of the joints. Necrosis may also
surface of one of the great joint
rare except as a complication of
the joint-surface. Limited nec
ever, occasionally met with, an
will set up abscess in the joint.
of articular abscess must be soug
THE JOINTS, and the indications
on EXCISION.

In the flat bones, where they
necrosis is an exceedingly com
been before observed, the dead b
out invagination. The same
portions of irregular bones, wh
cancellous tissue (such as those o
is by no means rare. Whole bo
bones, of the tarsus, and som
carpus, are found quite separat
and merely retained as foreign
In such cases there is sometim
the diagnosis; since the dead b
sensation usual in necrosis of co

However, though the cancellous tissue is sometimes affected h necrosis, it should be remembered that this is exceptional, d that necrosis is an affection more peculiarly of the compact ue, and especially of the densest bones. Thus the petrous ne is frequently necrosed, and has been known to exfoliate most entire.*

Treatment.—Hitherto we have been considering the usual thod of separation; and as this is a long and tedious pross, seldom completed under many months in the case of a rge sequestrum, and often dating by years, it is not surprising at efforts should have been constantly made to anticipate e period of cure by cutting away the diseased bone. These, wever, have hitherto resulted in disappointment. The pross must be left to find its natural completion in the spon- aneous separation of the dead bone from the living; and any tempt to effect this by operation, *i.e.* to detach the necrosed ortion, and to cut it away from the living parts, only extends ne area of the disease, and endangers the preservation of the mb. Special considerations, applicable to some regions of the ody, such as the skull, may indeed induce a surgeon to operate n necrosed bone before it is loose, for the relief of matter pent p below it: such operations, however, are not undertaken with a view of curing the diseased bone, but of restoring the unction of organs secondarily affected. Such has been the esult of surgical experience up to the present time. I have, however, pointed out above (p. 757), that a sequestrum of limited extent may be dissolved out by the action of sulphuric acid, or probably of potassa fusa, and thus the slow process of vital action necessary for its separation may be anticipated. In order to obtain success, however, in these proceedings, it is essential to know exactly the limits of the disease.

But when the sequestrum has separated and lies loose and invaginated in new bone, surgical interference is most necessary. There is perhaps no part of surgery in which the improvements effected in comparatively modern times have done so much to preserve life and limb, and to obviate pain, as in the treatment of necrosis. The invaginated portion of bone can never get out by any natural process: the very completeness and efficacy of the efforts which nature makes to preserve the continuity of the bone, and to restore its strength, effectually imprison the dead portion. Small pieces or granules of dead bone constantly exfoliate from carious surfaces; but when the sequestrum is of any considerable size, the cloacæ are never so large as to admit of the escape of the sequestrum through them, although sometimes they are very nearly large enough. Thus, in the Museum of St. Bartholomew's Hospital, there is a curious specimen,* in which a small piece of loose bone, just too large to get out of any of the numerous cloacæ which have formed around it, is found rattling about in its cavity as if in a dice-box.

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* *Path. Soc. Trans.* vol. vii. p. 335. A similar case occurred at St. George's Hospital, under Mr. Prescott Hewett's care; Museum, St. George's Hospital, series ii. 99.

The requisite operation consists in cutting down on the dead bone, and exposing it sufficiently to remove it. If the necrosis be superficial, nothing is required beyond turning back the soft parts, which have no connection with the dead bone, elevating the latter, and pulling it out with a pair of forceps. But, for the removal of an invaginated sequestrum, it is necessary to open the sheath by enlarging one of the cloacæ with the trephine, or cutting forceps, until it is large enough to admit of the extraction of the piece. Sometimes, when the sequestrum involves a large portion of the shaft of the bone, it may be found impossible to get the piece away until a pair of cutting forceps or a trephine has been introduced through the enlarged aperture, and the dead bone divided. In the necrosis which so often attacks stumps after amputation, a ring-like piece may separate from the end of the divided bone. Its extraction is then a matter of considerable difficulty; but still, as there is a free opening on to the extremity of the dead bone, it may be accomplished with some little trouble. If a similar sequestrum should form on one of the long bones, involving a ferule-like portion of its surface, its removal would be still more troublesome, requiring free incisions on both sides of the limb: but I am not aware that such cases have been noticed in practice. A preparation in the Museum of St. George's Hospital (series ii. 75) shows a strip of necrosed bone winding spirally, for a considerable distance, round the shaft of the humerus.

It has sometimes been made a question whether the sequestrum of necrosed bone can be removed by a gradual process of disorganisation and molecular decay. If this question be proposed

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* Sub-series A, No. 94.

n essay in scientific pathology, there is no doubt of its great
rest; but viewed as a practical consideration in surgery,
lly any value attaches to it. Experiments on animals
inly appear to show the possibility of the removal of small
es of excised bone reimplanted in the excision-wound;* and
possible that, in the human subject, sequestra of bone may
some extent eaten away by a process of absorption like
which sometimes removes the ivory pegs driven into bones
he cure of ununited fracture (see vol. ii. p. 92); † but even
ring all upon this head which any one could reasonably
ce from such facts as these, we should still be justified in
g that the process is so slow, so uncertain, and so partial,
no account ought to be taken of it in surgery.‡

is therefore necessary, in every case in which a sequestrum
s, that a surgical operation should be undertaken for its
val. The word *sequestrum* is here used in its strict sense,
press a portion of dead bone contained in a case of new
. An *exfoliating* portion of bone may separate and be
wn off by the natural processes, though it is usually
ssary to facilitate its removal when loose by incisions.

question is sometimes raised, whether it is prudent to
ate as soon as the operation is possible, *i.e.* as soon as the
is loose, or whether a certain time should not rather be
n, in order that the newly formed bone may become conso-

Heine, in *Gräfe und Walther's Journal*, Bd. xxiv. p. 527, quoted by
ier, op. infra cit. p. 146.

case showing this absorption very clearly has been put on record by
Cleland, in the *Brit. Med. Journ.* for Feb. 22, 1868.

t may reasonably be doubted, also, whether the absorption said to have
red in some of the experiments above referred to did really take place, or
er the whole thing was not a mistake on the part of the experimenters.
er's experiments (*Med.-Chir. Trans.* vol. xxi.) show that portions of
bone, thrust into the tissues of living animals, may remain an indefinite
without experiencing any absorption, as proved by careful weighing at the
ning and end of the experiment. Again, cases such as that quoted on
5, prove that a portion of bone, of no extraordinary size, may remain
ed during a great part of a lifetime, and suffer no perceptible diminution
. This is the case even when its mechanical connection with the rest of
dy is not entirely destroyed. But surely when loose and separated from
ing tissues it must be still less under the influence of the vital actions.
aper by Mr. Savory, in the *Med.-Chir. Trans.* vol. xlvii., several experi-
are described, showing that the absorption of dead bone driven into the
bones of animals, is proportional to the pressure to which it is subjected,
ition which hardly exists in the cases of necrosis that occur in practice.

lidated, and the limb sufficie
The question, however, is r
harm appears ever to result
bone, but much mischief oft
remain. If, in rare cases, t
weight of the body or the m
this is a consequence, eithe
periosteum as finally to precl
tutional fault, or other predi
excited by the presence of t
bone has probably not pass
from the same low rate of
deposit furnished by the peri
and low in organisation. In
that the best chance for rest
would be afforded by the ope
cause of the inflammation w
destroyed. It would, theref
the dead bone, and put the li
of irritation, and expect a ce
tion of the cause.

It is not always easy to de
bone is loose or not, since th
or even the shape of the loos
the parts around it, may p
probe. Of this fact an insta
and the reader may consult a
Medical Times and Gazette, M
where the disease has lasted
reasonably expected to be co
remove the bone, even altho
sive evidence that the operat

It is necessary here to say
and the manner, of regenerat
from necrosis. In doing this,
in an essay of this sort, to
approach to completeness; b
found in the following par
necessary for practice. The
about the matter is referred t
Flourens, Syme, and Wagner.

The most important agen

rosis is, without doubt, the periosteum; and this membrane sufficient of itself to replace all the ordinary exfoliations and rtial necroses which follow injuries, &c. The osteogenic perties of the periosteum, when in contact with the bone, ve long been known, in fact must have been apparent when e function of the membrane was first studied; and that riosteum, when separated from the surface of the bone, will ll generate new bone, is no very novel discovery, since John ll seems to have been perfectly acquainted with the fact, d describes the formation of a bony cyst by secretion from e detached periosteum, around a collection of blood which d dissected off that membrane from the bone;* and the periments of Syme and Stanley are well known. Lately the teogenic powers of periosteum have been placed in a very riking light by the experiments of M. Ollier of Lyons.† He as shown that, in rabbits, portions of periosteum may be ntirely detached from the bone, and pushed into the cellular issue of the limb, or even grafted into remote parts of the ody, or into the body of another rabbit, and that bone would e generated from the fragment of periosteum in this novel osition. He has even succeeded in producing bone by such rafting of portions of periosteum kept for more than an hour ut of the body.

It is far from certain, nay, it is most improbable, that any such results could be produced in man, since the conditions of all reproductions, and especially of reproduction of bone, are known to differ so much in man and animals; but, even if the vitality and osteogenic power of the periosteum be less in the human subject than in the lower animals, still it seems reasonable to infer, from observed phenomena, that that power is of the same nature; so that these striking experiments may serve to fix more firmly on the attention of surgeons the importance of preserving the periosteum in cases where the reproduction of lost bones is in question. In all cases, then, where loss of substance in bone has taken place, or where the bone seems

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* *The Principles of Surgery*, by John Bell; a new edition, by Charles Bell, 826, vol. iv. p. 406. The pathology of the case, as related by the author, is ufficiently obscure; but the case may be used to show that Bell knew that one could be formed from the detached periosteum.

† *British Medical Journal*, 1860, pp. 398, 438; *Traité de la Régénération des Os*, Paris, 1867. I may mention that some of M. Ollier's experiments have been epeated and verified by numerous experimenters, amongst others by myself.

deprived of life, it is of the greatest impo
periosteum should be preserved, a point whicl
again in the essay on EXCISION, in speaking
resection.

It has frequently been made a question, on
of reproduction depends, whether on the acti
membrane itself, or on the detachment, togeth
strata, of small particles from the surface of
serve as nuclei, around which new bone grows
to prove that such nuclei are not detached in
there is no evidence that such is the fact. Bo
known to be produced from portions of perios
been previously carefully examined, and no suc
while in other cases it has appeared probable th
had carried fragments of bone away with it. M
that a 'subperiosteal blastema' exists natur
periosteum and bone, and that this is th
deposit.

The periosteum, however, although the mo
not the sole agent in the reproduction of bone
be confidently expected that bone will be repro
subjects, even though the periosteum be exten
but the reproduction will not be so complete as i
had been left. Such a process of reproducti
watched in cases where the soft parts hav
scalp-wounds, and have left the cranium exp
cident will often be followed by exfoliation fro
the bone; granulations then shoot up from the
exposed, and these are joined by others whic
the soft parts in the neighbourhood: a fibrous c
which can be felt gradually hardening and c
opportunity occurs for examining it after th
considerable time (say half a year), it will be
fibrous tissue of the cicatrix is ossifying at its d
scattered granules of bone will probably be me
parts of the cicatrix.

This process may go on even when the bone
have been removed by operation, as in the woun

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[*] See Wagner, *On Repair after Resection of Bones* (New S
p. 241, for a case in which this form of reproduction is wel

[†] See Wagner, op. cit. p. 156.

is much more active when previous inflammation has been ted in the medullary tissue, and surrounding soft parts, ng the action necessary in order to eject a piece of necrosed e. In fact, speaking generally, the process of reproduction r necrosis is beyond comparison more active than after ry or operation. Thus, when necrosis has preceded the ration, whole bones of the fore-arm have been removed, and a useful limb has been preserved.

a case which I had an opportunity of seeing, in which Mr. Savory oved the entire shaft of the radius on account of necrosis, leaving the cular ends,* the bone had grown from each of these ends to so great an nt that in eight months after the operation there remained an interval of f an inch and a half, and this appeared to be gradually, though slowly, tracting. This and several similar cases will be found quoted in Wagner's tise above referred to, and may serve as an encouragement for boldness in attempts to save limbs after extensive necrosis.

The exfoliation of diseased portions of bone, such, for example, takes place so frequently in the course of extensive strumous sease, when a portion of the ulcerated surface is cut off from e rest, and therefore perishes, is not generally accompanied any of that reparative effort which forms part of the process a more healthy condition. The mere presence of necrosis in ch affections is of comparatively little importance; possibly removal of the dead part may be advisable (but only if it be done without much violence), but the operation cannot expected to cure the disease, since the necrosis is not its use, but its effect. Nevertheless considerable improvement y, in appropriate cases, be expected to follow on the removal the dead portion, which must always act as an irritant; and exposure of the carious surface is also very frequently the rting-point of a more healthy action. Hence when bone is t exposed and dead, it is usually advisable to endeavour to nove it, even although the surface around it is known to be ious.

The above description applies to necrosis in its more usual m. But besides this common chronic form of the disease, an ction which deserves the name of *acute necrosis* is sometimes, ugh not very often, met with. The destruction of all the parts surrounding a small bone, as a phalanx in acute lected whitlow, will of course lead to the exfoliation of the

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* See Wagner, op. cit. p. 243

whole of it, and to this affection
sometimes given. There is noth
or treatment of such a disease
bone. The rapid and tensive
parts of equal importance—the
cases even the skin—with destru
of the products of the inflamma
which any good can rationally
less-known class of cases in whi
rapid destruction, without kno
parently quite inadequate; and
local mischief, but very grave da
of rapid necrosis are the result
the periosteum which has been
which I have had an opportun
detect such a cause for the dea
cause to which so extensive an
reasonably be ascribed.

Such a case was the following. A sta
Hospital on account of disease in one
seemed certain that little more than thr
comparatively well, as it was to an inju
days before his admission, in running vi
disease was attributed. There was œde
of the foot; and this condition was attri
and treated by superficial incisions, whi
The man died, with symptoms of pyæ
days after his admission. On examini
found loose, and grating on each other
between them had almost entirely disap
a dark-grey hue, and some slight trace
interior, but no such distinct indicatio
brane of the cancelli as to deserve the
periosteum thickened, vascular, or separ
either lymph or pus in any appreciable
exposed by the removal of the articul
deeply. The bones were of their natura

Is such an affection as this
This seems doubtful, if it be
necrosis really exist in which
diffuse periostitis. In the latter
succeed, as has been already said
restoring the nutrition of the
tissue be involved at once, what
pected to restore it to health?

in such a case is, whether the patient's powers will endure strain of the disease, so that the bone may be cast off, and nay have the chance of its reproduction, or whether ampu-on will give him a better prospect of life. But the prognosis an amputation undertaken under such circumstances would in the highest degree unfavourable, since the condition of em in which such grave results can follow from such trivial ries leaves little prospect of bearing up against so serious injury as the removal of a limb; and the tendency to pyæmia o strong that it is impossible to say that that condition of system may not be actually present, though latent, when operation is done. It will therefore, in most cases, be ged better to support the patient's strength by a liberal owance of tonics and opiates until the graver dangers have sed away; and then, if the usefulness of the limb is hope-sly destroyed, to remove it when the patient has rallied from e typhoid condition in which the disease commences. Inci-ons may not have the power of averting the death of the ne, but they ought to be made to an extent sufficient to erate all tension, and that for two principal reasons—partly order to avoid sloughing of the periosteum, and consequent struction of the nidus in which the new bone is to be formed, rtly to provide a ready way for the pus, which must form, escape, and for the examination of the bone and its eventual traction.

Acute necrosis, whether resulting from diffuse periostitis or t, may be treated by the extirpation of the whole bone so ected, a very free incision being made through the perios-um, which will be found completely separated from the bone, d the bone being, if necessary, divided by a chain-saw passed derneath it. In cases of necrosis of the entire diaphysis of a ng bone, a slight twist with the lion-forceps will detach the ad portions from the epiphysial lines above and below. In is way I removed successfully the whole shaft of the tibia even and a half inches long), at the age of ten, one month after e commencement of acute periostitis, with very successful sults.* I think, when we have clear reasons for believing that

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* *Lancet*, 1866, vol. i. p. 340. See also *Surgical Treatment of Children's iseases*, 2nd edit. p. 391, et seq.; where other instances under my own care are ated; also a case by Mr. Joseph Bell, *Brit. Med. Journal*, May 2, 1868, very nilar to a case of mine in the femur, but more extensive.

the necrosed bone will be found loose, its early remo
desirable, and liberates the patient from great dang
the present, from the acute surgical fever kept up b
tion of the diseased bone, and in the future, fro
incident on the numerous and severe surgical opera
will probably be necessary for the removal of so
sequestrum. I do not recommend the operation
tion only of the diaphysis has perished, and has n
rated. The old idea that it is necessary to wait in
for the formation of a periosteal sheath of bone, i
refuted by my cases and that of Mr. J. Bell, whic
even in so large a bone as the femur a great portio
not see why not the whole, if such a case should o
entire circumference of the shaft may be removed,
be left perfectly flail-like after the operation, and ye
solidation and perfect usefulness of the limb may f

CONSTITUTIONAL AFFECTIONS.

Scrofula in bone.—There are two forms in whic
affections of bone are met with : viz. either a deposi
or a low inflammation of the osseous substance ;
good reason for considering the former as a conseque
of the latter. Let us, then, first consider the pec
tinctive characters of scrofulous inflammation of b

A scrofulous bone, when examined in the early
disease, is soft, light, and oily; sometimes more hi
with blood than natural, and occasionally (though
presenting a deposit of tubercle in its interior. B
condition are constantly met with after the removal
joints: the substance of the bone is easily cut with
the cancelli are large, and charged with a red jelly
débris. The inflammation readily passes into u
caries, and the bone then exhibits on its surface
minute pits, or depressions, from each of which th
extends, so as to communicate with those arou
extensive worm-eaten surface is exposed,* soft and
exterior, bleeding readily, and giving exit to a f
ichorous pus, in which pieces of decomposed bone
as gritty particles under the fingers. The perioste

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* For the appearance of scrofulous ulceration in the mac
contrasted with simple ulceration, see Figs. 189, 190, p. 752.

ched and thickened, and is gradually converted into a tinous mass of granulations.

he minute changes in the ultimate tissue have been ably cribed by Dr. Black, in a series of researches to which my n observations lead me to assent. The cancelli are dilated, l they, as well as the lacunæ and canaliculi, are filled with dation. Occasionally, minute projections of bone from the lls of the cancelli indicate an attempt at the reproduction of ne, and that healing by sclerosis which has been already scribed as one of the usual events of healthy inflammation. e leading features, then, of the pathological anatomy of rumous inflammation are the same as those of ostitis in neral; and the only distinctive anatomical peculiarity consts in the nature of the exudation, which chokes up the canals the bone. Dr. Black has given several analyses, tending to tablish these four conclusions: that tuberculosis gives rise) to a considerable increase of fat in the diseased bone; (2) to large diminution of the salts of lime; (3) to a diminution of he organic matrix; (4) to an increase in the soluble salts. or the details of the analysis, the reader must be referred to he original treatise.* They serve to illustrate the fact, that trumous is distinguished from common inflammation by the oftness, lightness, and oiliness of the affected bone; to which nay be added, the greater extent of diffusion of the morbid hanges.

The superficial caries, during the mere presence of which, the bone, if the affection be not very extensive, is possibly still in a curable state, spreads gradually inwards, and then the condition of the bone passes beyond the possibility of repair. Large abscesses form, and the whole cancellous extremity, or the whole bone if it be one of the cuboid bones of the tarsus or carpus, is converted into a cavity bounded by a thin shell of osseous matter, and containing bony substance, either in mere débris, or so soft that it will crumble away in maceration. These abscesses are seldom accompanied by that thickening of their walls from periosteal deposit which takes place in simple ostitis; still, at some distance from the seat of profuse suppuration, fresh deposit is sometimes found thickening the bone, or producing anchylosis in joints which enjoy little motion. Necrosed portions of larger or smaller size are often found, but

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* *On the Pathology of Tuberculous Bone*, p. 32. Edinb. 1859.

no 'sequestra' in the proper sen
necrosed portions invaginated by

Such are the anatomical chara
tion of bone. The other commo
in the osseous system consists in
circumscribed or diffused. Circu
rarer form) seems most common
outside of the bone beneath the p
and next to this its favourite lo
joint-end of some bone, generall
seems to be produced by such tu
if situated in the articular end
a passage into the neighbourin
the skull, the softening of such
abscess difficult to heal, border
with cold, bluish edges, and lead
bone, which, however, has not th
and is not at first dead, altho
The deposit of diffused tubercle i
of the long bones. It fills up
nodulated, or granular, yellowish
extends frequently along the wh
own impression is, that this di
and less rapidly softens than
information on this point is want
that when the shaft is attacke

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* Tubercle in bone is, in any view of t
referred to in vol i. p. 357, give a low pl
tubercle; though they place the bones a
testicle and epididymis, which is hardl
experience of most surgeons. But the n
of as tubercular is the subject of much
pathologists. Dr. Wilson Fox says:
proceeded so far, that, if the exclusi
category of tubercle, proposed by vario
carried out, tubercle would—not unfo
certainly have no longer any place in o
logical product hitherto ranked under th
the yellow granulation and the cheesy in
excluded from the category of tubercl
p. 22. My opinion is, that many of the
tubercles in bone, are masses of inspiss
matory products; and that, rare as tuber
in reality still rarer.

isease, the extremities usually escape, and *vice versâ*— atter of great importance in the treatment of diseases of joints.

has occurred to me, though hitherto only on two occa- ns, to meet with a particular form of ulceration, which was ne case certainly,* and in the other probably, connected h scrofula.

umerous pits were found on the articular surface, varying in depth, but ined to the epiphysis, with sharp edges, and curdy purulent contents. ir openings into the cavity of the joint were cleanly punched out of the ilage, and all the cartilage around was quite healthy. A few small granules one were met with among the contents of the cavities. In one of the s, when the bones were examined, there were found several spots of cular and softened tissue beneath the surface of the bones, evidently the mencement of similar pits. There was no trace of tubercle. The thigh amputated, and the patient recovered for a time, but soon died of phthisis. the other case, the patient, a boy under the care of Mr. Thomas Smith, overed after excision of the knee, and remained long afterwards in good lth.†

I believe this pitting or spotted ulceration of the articular ds of bones to be one of the forms of scrofulous disease, and be indistinguishable from its other forms before dissection. presents a very favourable condition for resection, from the rict limitation of the disease to a very slight depth below the rface.

Symptoms.—Of the symptoms of scrofula in bone little need said here. The general symptoms of the diathesis, added to indolent swelling of some bone, lead to a diagnosis not to mistaken. The swelling is composed partly of the engorged ft tissues, and partly occasioned by real enlargement of the ne. The colour is usually white and pasty,‡ and the swelling dolent; but sometimes, when the inflammation is higher an common, and suppuration imminent, redness and pain ay be present. When suppuration has been effected, the in generally subsides, and the functions of the part are more less completely regained, even when the bone is destroyed to considerable extent.

Treatment.—The treatment of scrofula in bone offers little at is peculiar. For local treatment, perhaps the most important indication is to keep the part at rest by splints and bandages during the prevalence of inflammation. Local depletion should be cautiously used while there is pain, tenderness, and superficial redness, or the part may be enveloped in a large warm poultice or fomentation. When inflammation is not apparent in the soft parts, but there are signs of its presence in the bone, it will be necessary to use counter-irritation by caustics or blisters; or in less severe and more chronic cases by means of the tincture of iodine, or other stimulating application. When irritation has subsided, pressure by means of strapping will be found very serviceable, both in ensuring rest and in promoting absorption, and the local action of mercury (Scott's bandage) may be combined with this. By these simple measures, with judicious constitutional treatment, most of the cases of strumous inflammation, which are seen before the occurrence of suppuration, will be brought to a favourable issue.

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* A notice of this case will be found in *Path. Soc. Trans.* vol. x. p. 217.

† This is figured in the work above referred to, *On the Surgical Treatment of ildren's Diseases*, p. 488.

‡ The 'white swelling' of old authors was named from strumous disease of e joints, though many other affections came to be included under the term.

When the suppuration is once established, it is better to procure exit for it by small incisions, and to use every precaution to prevent the denudation of fresh portions of bone. The question, however, of the early or late opening of abscesses connected with strumous bone is one on which a good deal of difference of opinion very naturally exists, and which is best determined in each individual case. If such abscesses are allowed to go on increasing, the soft parts may be extensively undermined, the disease may extend to fresh bones, and an opening may form in a disadvantageous situation. If opened early, the cavity may be attacked with inflammation, which, if the abscess be large, may even prove fatal. If, however, the abscess be near an important organ, as a joint or serous cavity, then undoubtedly no time should be lost in evacuating it. Large openings should be avoided; but the introduction of a piece of lint, or a drainage-tube, will keep the discharge flowing; or the abscess may be emptied by means of a trocar from time to time, and the access of air thus effectually precluded. When the bone is exposed through the opening of an abscess, its condition should be thoroughly investigated, once for all, with the probe, in order to judge of the necessity for operative interference; but nothing is more mischievous than repeated meddling with diseased bone. The general indications for operations upon bones affected with strumous caries, and the form of operation indicated, will be the same as in caries nding upon other causes; but the prognosis will be less urable than when the constitution is unaffected, and there- operations should be undertaken with more caution. rations on these cases will usually succeed or fail according rofula has attacked the viscera or no, and according to the nt of its diffusion through the system; but even after a essful operation the patient is by no means secure against lapse in some other part.

or the general treatment the reader must be referred to the y on SCROFULA.

yphilitic affections of bone.—The chief phenomena of the ilitic affections of bone have been already spoken of sum- ily under the head of Tertiary Syphilis (vol. i. p. 482); it therefore only be necessary here to go a little more into il as to the anatomy of bone affected by syphilis, and the ns by which the disease is to be diagnosed. As the general tment of syphilis has been laid down in Mr. Lee's essay, the local treatment of its manifestations in the osseous em will be dwelt on here.

yphilitic affections are those in which the existence of a nic limited inflammation of the periosteum alone is most rly proved, if, indeed, such inflammation be not peculiar to ilis. Strumous nodes (as we have just remarked, p. 780) formed by scrofulous matter confined between the carious e and its periosteum, and are due to an affection of the bone; the true node, that which follows syphilis, is caused by the ion of lymph between the bone and periosteum, and is due nflammation of a limited portion of the deeper layers ('sub- osteal blastema') of the latter. Hence it is of a different ification from that of a strumous abscess; for while the r is merely a consequence of diseased bone, and necessarily lves corresponding loss of substance and the slow processes which alone an ulcer (and more especially a strumous ulcer) one can be healed, the syphilitic node is itself the starting- t of the disease in the bone, and if early and properly ted, the whole organ can be restored in a short time to a e of health. But although in a node the inflammation is lly limited to the periosteum, it is not always so. Nume- preparations show thickening of the substance of the bone ath nodes,* proving the implication of the deeper structures, and therefore a state of disease which, though still curable, m be expected to be more obstinate than mere periosteal effusio and if the skull be examined in the situation of a node, so roughening of its outer table may generally, perhaps alwa be discovered. The progress of nodes, when they are not sorbed under appropriate treatment, is in one of two directio either the subperiosteal effusion ossifies, or it softens gives rise to caries, accompanied usually by suppuration. former event is commoner on the tibia, the latter on the sk The indisposition of the pericranium to form new bone is a well-known fact in pathology, nor am I aware that the form tion of new bone in syphilitic nodes of the skull has ever b proved, though new bone may be sometimes found deposited the outer table of the skull in the neighbourhood of la ulcers;* in nodes of other flat bones also, ossification, if occurs, is rare. Many nodes appear so hard as to be pronoun osseous; but the feeling is often deceptive, since the tense thickened periosteum raised by semi-solid effusion gives a se sation hardly to be distinguished from that of a bony swellin Therefore, in a hard node which is of no long standing, trea ment for its removal may be confidently recommended, and the more if the swelling be situated on a flat bone. On th tibiæ nodes are prone to ossify, and then the deeper ossified part remains as a permanent irregularity on the surface of th bone; but the unossified portion may often be dispersed by appropriate measures. When a node softens, and the question occurs whether pus has formed, the case ought to be carefully examined, in order if possible to determine the point. The principal indication of the presence of pus is the shining, tense, and thinned condition of the skin. It is important to obviate more destruction of the skin than is inevitable on the bursting of the abscess, since such sores are very difficult to heal, and in some cases appear incurable. The best way is to make a very small puncture, and close it after drawing off the pus. Frequently, under the proper treatment, the soft parts will adhere again to the bone with very slight or no exfoliation.† It is

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* St. Thomas's Hospital Museum, series c, No. 54.

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* Even here it is in most cases doubtful whether the deposit has formed outside the skull, or whether the thickening is not produced by within the diploë expanding the outer table; for deposit in the exceedingly common. See below on the 'tuberculated' form of ulceration in bone.

† See Parker, *Modern Treatment of Syphilitic Diseases*, 4th ed. 18

cially in these cases of abscess communicating with the sur-
of a bone that I have found the treatment by carbolic acid,
mmended by Professor Lister, most successful. In several
s under my own care where I have had either positive proof
he strongest reasons for concluding that the abscess was
nected with diseased bone, I have found the abscess heal
lily, and without exfoliation. Many others have also been
on record by Professor Lister and other surgeons. Very
monly, however, the formation of periosteal abscess after a
e is followed by the exfoliation of most of the subjacent bone.
hilitic nodes are usually preceded, and always accompanied,
more or less of dull aching pain in the bone, especially liable
xacerbations at night; or this 'syphilitic rheumatism,' as it
ometimes called (the *douleurs ostéocopes* of French authors),
y be the only symptom referred to the osseous system during
progress of the secondary affection. Mr. Parker* is in-
ned to refer the pain to a syphilitic inflammation of the
dullary membrane.

When the syphilitic cachexia is further advanced, the whole
ne or a great part of it may be diseased through its entire
ickness, leading to chronic ostitis, and terminating in scle-
sis, or what is sometimes called 'hypertrophy' of the whole
ickness of the bone. I am not aware of any distinction
hich could be drawn between such instances of chronic in-
mmation and those arising from non-specific causes, except
at which is founded on the presence of concomitant and pre-
ding syphilitic symptoms in other organs.

Still more grave and more obstinate developments of tertiary
philis in the bones are those carious and necrotic affections
lcerative or gangrenous) which so often attack the skull, the
nes of the face, and the superficial long bones, in persons
uch reduced by excesses, or by the injudicious administration
mercury. In former times, under the horrible system which
evailed in the 'foul wards' of the great hospitals, where every
rson labouring under any disease supposed to be caused by
omiscuous intercourse was compelled to take mercury to
livation, the ravages of syphilis on the bones were dreadful;
d it is to this system that we owe many of the preparations
syphilitic caries and necrosis preserved in our museums.

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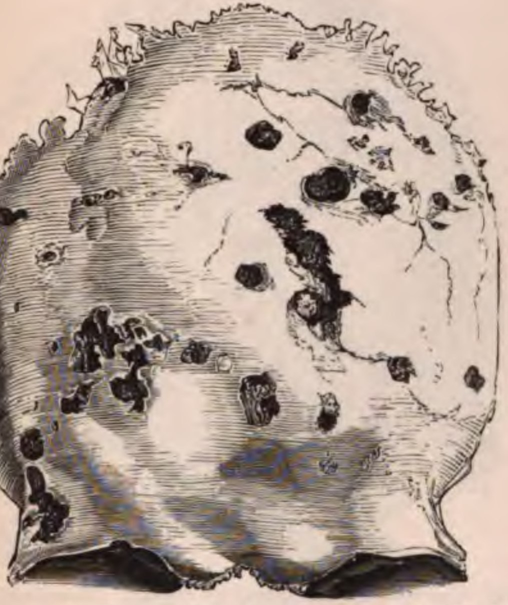
* Loc. cit.

bone around this worm-eaten central portion is marked by orescent grooves, the traces of increased vascularity. Later a circular trench is marked around the worm-eaten spot; l as this widens and deepens, it undermines and finally chisels the piece, which separates as a sequestrum, and then the ne scars over, leaving a rounded depression, much larger n the original spot, the surface of which is rather glazed d a little vascular, and the bone below it a good deal harned. In well-marked specimens, these *annular* ulcers, as ey are termed by Mr. Paget, (Fig. 192), look very charac-

FIG. 192.

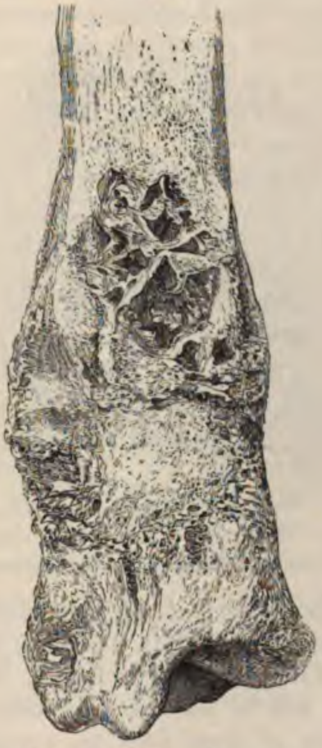


Syphilitic ulceration of the annular variety. (Museum of the Royal College of Surgeons, No. 635.)

teristic, but in less advanced cases, especially before the surrounding trench has formed, or again at a late period when cicatrisation has obliterated some of the more distinctive characters of the ulcer, it seems impossible to distinguish it from a scrofulous or other lesion. The other characteristic form of syphilitic ulceration is the *tuberculated* (Fig. 193), which appears to commence by a tubercular thickening of the external wall of the bone, recalling the syphilitic tubercle so common on the skin of the face, &c., and due not to periosteal with those of simple, strumous, rheumatic and malignant ation, which will be found at pp. 752, 793, 813, the reader be enabled to see at a glance much better than by verbal iption, the differences of these affectious as shown on the rated bone.

y of these forms of syphilitic ulceration may affect the so deeply as to penetrate its whole thickness. Thus in the

FIG. 194.



Syphilitic ulceration of the reticulated variety. (Museum of the Royal College of Surgeons, No. 630.)

um of St. Barthomolew's Hospital is a specimen (A 34) of vicle in which the bone has given way (probably after death) nsequence of penetrating ulceration attributed to syphilis. taneous fracture of a long bone, however, from penetration syphilitic ulcer is extremely rare; while penetration of a bone, especially of the cranium, is still a pretty frequent mstance, and used to be an ordinary result of syphilis. In reater number of such cases no serious mischief follows;

eve that the improvement is not permanent, and that for entire eradication of the constitutional affection a mild but longed course of mercury (for which the calomel vapour- h is the most appropriate agent) ought to be insisted on. ͽ local treatment of bone inflamed from syphilis presents eral interesting questions. Nodes will usually be benefited blisters, or if the bone seem to be more deeply affected, by persevering use of mercurial ointment, strapping with the pl. hydr. cum ammoniaco, iodine paint, &c. But when the in in the inflamed bone is constant and very distressing, it is ite justifiable to divide the periosteum by a free incision; and en, if nothing is found to account for the tension and to hold t a prospect of its relief, a trephine may be applied to the ne itself, and its medullary canal laid open.[*] If symptoms cerebral disturbance make their appearance in the course of eration of the cranium, the application of the trephine has metimes been successful in preserving life; but, on the other nd, it is not to be denied that it has sometimes produced or stened death. The proverbial obscurity of all cranial affec- ns ought, I think, to make us cautious in adopting so extreme measure as trephining the skull, unless in a patient whose te is otherwise evidently hopeless. Epileptic convulsions, en with slight symptoms of paralysis, are hardly a sufficient lication for the operation; but the experience of Mr. H. e[†] has shown that in some cases the removal of the eased bone has been followed by the healing of ulcers which d previously been obstinate; and it seems that the removal the outer table only, when it is dead, and appears to be eping up irritation, is a safe practice.

The treatment of fissures and defects of the palate from philitic necrosis will be found discussed in a subsequent ay.

Rheumatic and gouty affections of bone.—It is extremely diffi- lt to be certain of the existence of any specific affection of ne due to the rheumatic diathesis. Rokitansky, in his ttempt to determine the characters of the constitutional ections of bone, particularly the inflammations and caries, by reference especially to the appearance of the bone after maceration,'* doubts 'whether rheumatism gives rise to an inflammation that can be distinguished by any definite character of its products, or to any particular caries, however positively assertions be made on the point;' but there is no doubt that common ostitis is very generally produced by exposure to cold and wet, and other causes, which at the same time generate rheumatism, nor is there any reason whatever for questioning the universal opinion of persons of experience, that those who are the subjects of rheumatism are also those who are most prone to inflammation of the superficial bones, such as the skull, tibia, &c.

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[*] Parker, op. cit. p. 283.

[†] *Proceedings of the Med.-Chir. Soc.* vol. iii. p. 283.

The disease now commonly called 'chronic rheumatic arthritis' or 'osteo-arthritis' is regarded by some authors of credit as originally a disease of the bone. In this work, however, it is considered as commencing in the soft tissues of the joint (see Diseases of the Joints).

I would not be understood, however, to deny the existence of an affection which deserves to be called 'rheumatic ostitis.' The condition of the articulating extremities of the bones in cases of osteo-arthritis is very peculiar, and can hardly be explained by any theory except that of some constitutional peculiarity in the disease, since neither the age of the patient nor the mode of causation of the malady offers any constant features which can account for the singularity of the affection of the bone. That which is most characteristic in all those cases which appear to be rheumatic, is their very slow course, and the great length of time during which inflammation may be present without either caries or necrosis. In all rheumatic affections of the joints, and in many of those of the limbs, although it may be true that the complaint originates in the fibrous tissues, yet the bones will become involved if the disease lasts long enough; and in that case the principal features will be in the shaft of a long bone, extensive stalactitic or foliaceous laminated deposit from the periosteum, and sclerosis of the superficial portions of the bone; the medullary canal and the deep cancellous tissue being usually, if not always, unaffected. In the Museum of the Royal College of Surgeons, Mr. Paget has classed some specimens† as 'rheumatic ulceration,' in which, along with these appearances on the shaft of the bone

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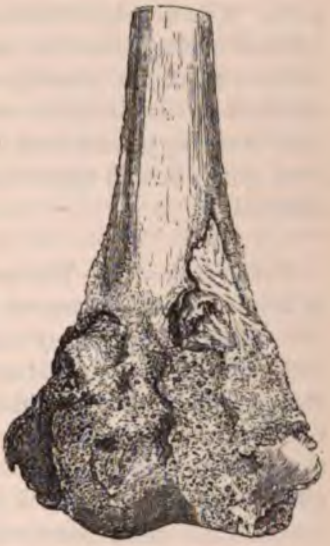
[*] *Path. Anat.* (New Syd. Soc. Trans.) vol. iii. p. 202.

[†] Nos. 626, 627, 627 A.

ration is seen invading the newly-formed periosteal deposit. of these preparations will be found represented in Fig. 196. ny case, the occurrence of nodes, and more or less of inflam- ion of the wall of superficial es in cases of rheumatism, is a ciently probable event; but it complication which must be ted on general principles. The es do not affect the limited ex- and rounded outline of those to syphilis, but are irregular llings of the periosteum, involv- a considerable extent of the face, and probably some of the ckness of the bone.

Fig. 196.



Rheumatic ulceration of bone. (Museum of Royal College of Surgeons, No. 627.)

The most characteristic effects rheumatism, however, are dis- yed upon the articulating ex- mities; but as this disease will found fully described in the ay on Diseases of the Joints, vill not be necessary to say much out it here.

The chief features which are stinctive of rheumatic inflam- ation of the bones are, the extensive deposit of bone in the rous structures around, the condensation and thinning of the ell of the bone, the rarefaction and partial absorption of its terior, and the consequent change of shape which parts con- ining much cancellous tissue, such as the articular heads and ecks of long bones, suffer. In the articular disease the new ne is found, to a great extent, in the ligaments and other ssues distinct from the periosteum, and thus forms what Dr. dams calls 'additamentary bones,' which have been so often istaken for portions fractured off the bony prominences, near hich they may be situated, and remaining ununited. I shall lduce some reasons for believing that many of the specimens which portions of bone have been found near the shafts of ng bones, but movable upon them, and which have been ought to be instances in which exostoses had been fractured their base, may be of the same nature.

ral consistence.[*] When the whole bone is affected, it can be lly bent, and resembles, in extreme cases, as Dr. Ormerod[†] rks, rather a portion of fatty matter enclosed in a case of steum than a bone. If the cancellous tissue (in which the se appears to originate) be examined, it is found that the are enlarged, sometimes to such an extent that the whole is expanded, and are filled with a peculiar reddish gela- rm matter, in which, on microscopical examination, much nd oil can be discovered, together with blood-discs. Besides (which are the common products of any degenerative ge), certain peculiar nucleolated nuclear bodies have been ribed by Mr. Dalrymple.[‡] Instances of bones affected with ities do, however, occur, in which the amount of fat is not lly increased. Thus in a specimen in Guy's Hospital um (No. 1004^{88}), taken from a case reported by Mr. Solly, e 27th volume of the *Med.-Chir. Trans.*, it is said that the sed tissue consisted simply of an organic matrix, with little y matter, and containing little fat. Cases like these show it is impossible to describe mollities as simply a fatty neration. Degeneration of some sort is, however, always nt; and as this advances, it involves the compact walls of bone, and then the disease becomes for the first time nisable, by the symptoms which will be immediately ibed. At a later period, the whole bone is found to be ved, and becomes a mere bag of soft matter enclosed in eriosteum, which, perhaps, may be somewhat thickened, t does not appear that any further destruction of the bone occurs. It is merely converted into a soft, generally material, which crumbles away on maceration, but which s capable of resisting absorption for an unlimited period g life.

e symptoms of mollities are sufficiently striking in a well- ed case to attract immediate notice, however obscure may e real nature of the constitutional affection. The patients

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s in Dalrymple's case, referred to below.

rit. Med. Journal, Sept. 10, 1859.

ublin Quarterly Journal, 1846, p. 85; see also *Path. Soc. Trans.* 1846–7, . It is said that in bones affected with mollities, lactic acid and lactates be discovered, and that this lactic acid promotes the solution and tion of the phosphate of lime. The fact, however, appears doubtful. ivon, *Arch. gén. de Méd.* 1867, vol. x. p. 608.

ently, however, the patient does not die of the disease at
ut, having lived under its influence for many years, is
d off by some totally different complaint.[*]
ith these symptoms it is not surprising that this disease
ld have been claimed as merely a rarer form of several
r-known affections of bone, to all of which it bears some
nblance, however little they may seem to bear to each
r. Some authors[†] consider mollities to be merely fatty
neration, or atrophy of bone; others regard it as rickets
king the adult; while many class it with cancer. Now
of these opinions has a basis of probability, and it is very
ible that many of the cases of so-called mollities might
greater propriety have been entitled 'atrophy' of the bone.
his Mr. Curling's case appears to have been a good instance;
the difficulty which some authors have expressed in dis-
uishing between mollities and fragilitas ossium[‡] appears
ave arisen from their having compared together cases in
ch there was no real difference, and where the name mollities
been given to simple atrophy.
he connection between rickets and mollities appears, at first
ht, a very close one, on account of the bending of the bones,
liability to fracture from slight causes, which characterise
h. Some patients, also affected with undoubted mollities,
ve suffered in their youth from rickets.[§] Still, if we consider
question attentively, the differences between the two affec-
ns far exceed their resemblances. Rickets is an affection of
rly life, closely allied to scrofula in its causation and in its
re; it is peculiarly amenable to treatment; and under favour-
le circumstances the constitutional cachexia, which is its
sence, readily disappears as the child grows. Mollities hardly
er makes its first appearance till after middle life; and, even
those cases where the patient has been rickety, not till long
ter the cachexia of that disease has subsided; it shows no
liance with scrofula, and is not amenable either to the remedies
r that disease, or, as far as is known, to any other remedies,

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[*] Thus in Dr. Ramsbotham's case (*Path. Soc. Trans.* 1846-7, p. 148) the
ient died of pneumonia, after suffering for more than six years from mollities.

[†] See Mr. Curling's paper in *Med.-Chir. Trans.* vol. xx. p. 356.

[‡] It would be well if the term fragilitas ossium were allowed to become
olete, since it only describes a symptom common to several affections.

[§] This was the case with Dr. Ormerod's patient above referred to.

> be detected in pus, and in the secretion from the vesiculæ seminales. substance must be again looked for in acute cases of mollities ossium. reddening of the urine on the addition of nitric acid might perhaps lead e re-discovery of it; when found, the presence of chlorine in the urine, of h there was a suspicion in the above case, should be a special subject of stigation, as it may lead not only to the explanation of the formation of substance, but to the comprehension of the nature of the disease which ts the bones.'

hese cases, then, of what we may call true mollities, are dis- guished both from atrophy and from cancer by special charac- s: from simple atrophy by the existence of vitiated secretion, ving the affection of the constitution, and by the presence the affected bone of special morbid elements; although the ter difference can hardly be appreciated during life, except those rare instances where the bones are swollen. From acer they are distinguished by the strict limitation of the rbid product to the affected bones, and by the different ogress of the constitutional affection; since the patient, if he es of the disease at all, dies of the exhaustion produced by tiated secretion, or from the effects of mechanical interference ith the viscera; not, as in extensive formation of cancer, from rverted nutrition, still less from transference of disease to mote organs.

Our knowledge of the true pathology of this complaint is as et quite deficient, and so it follows that no means of treating ; are known. The patient's strength must be supported, and e must be guarded from all exertions and shocks. If bed- idden, his position must be accommodated to the shape of his imbs, so as to correct, if possible, the existing deformity by gradual traction, and to prevent any greater distortion. The fractures which occur in these cases are sometimes excessively numerous. Dr. Ormerod's patient had 'at one and the same time no fewer than seven fractures of different bones.' Yet in this case the fractures used to unite with the same readiness as they do in rickety bones.

Many of the cases are hardly subjects for treatment, since the disease in the bones and the distortion of the limbs has advanced to an unmanageable extent before the patient is seen; and it would be scarcely desirable, even if it were possible, to protract the course of a painless but inevitable decay.

Cancer in bone.—All forms of malignant disease are met with

of the bone. In this condition it forms one of the affec-
s of bone which are included under the name 'mollities
m,' under which head it has been referred to above. The
osteal form of cancer appears to be the more common in
long bones, while the interstitial is certainly the one more
lly met with in the flat bones, such as the skull and pelvis,
in the joint-ends. The interstitial form is found in the
e of nodules of various, but usually small, size, scattered
at the cancellous tissue. They are whitish in colour when
ll and recently deposited, and generally give out a creamy
e under pressure, exhibiting the various cell-forms usually
with in the juice of malignant tumours. In the harder
d of these nodules, following scirrhous cancer in the breast
d to which the designation 'scirrhus of the bones,' used by
e writers, applies, while others call them 'hard encepha-
l'), I have sometimes been unable to recognise any cancer-
e, or any cell-structures characteristic of cancer.* This
rstitial deposit of cancer is productive of constant and
ring pain in the part, very frequently followed, in a long
e, by fracture on some slight injury or even muscular exer-
n. After some time, during which, if fracture has taken place,
may have consolidated, a tumour makes its appearance.
e disease, having overcome the resistance of the periosteum,
w grows rapidly. On dissection, a large mass of soft cancer
found, in which the periosteal envelope of the tumour may
may not be recognisable, and which springs from the bone
a narrower base, while it generally extends further in the
ncellous tissue, or to a still greater extent in the medullary
nal. In rarer cases, several separate nodules are found
attered about the cancellous tissue. The bone in the neigh-
urhood of the cancerous deposit is often thickened,† some-
nes to an extent that can be appreciated by external exa-
ination.

The accidental peculiarities of shape and arrangement in the
rious specimens of interstitial deposit of cancer have given
e to different terms, which having now lost some of their
gnificance, ought to be, and have very generally been, allowed
become obsolete. Thus, when such a deposit in the articular
d of a bone grows into a number of cancelli in different

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* This was so in a case reported in *Path. Soc. Trans.* vol. xi. p. 220.

† Paget, *Surg. Path.* vol. ii. p. 362, ed. 1853; *Path. Soc. Trans.* vol. x. p. 249.

than scirrhus, although its progress in the bone may be what less rapid than elsewhere. But besides the encepha- all other forms may in exceptional cases be met with. e pathologists, indeed, deny the existence of scirrhus in bones, preferring to class the small hard nodules found he spine, skull, and long bones, secondarily after scirrhus the breast, and more rarely after scirrhus of other s, as 'hard encephaloid.' The difference in nomen- re is a matter of no importance. Hard cancer, indeed, n deposited in the bones, cannot of course draw to itself neighbouring parts and thus reduce the volume of the n in which it is placed, so that it is destitute of that kering so characteristic of scirrhus of the breast. But in r respects it seems identical. The small irregular lump, king under the knife, emitting a very scanty juice, and pre- ting under the microscope, besides a good deal of common ous tissue, only small nuclear bodies, and those perhaps in very large proportion, bears a sufficiently close resemblance cirrhus in other parts to deserve the same name, more espe- lly when only another product of the selfsame disease. ithelial cancer attacks bones usually in the course of a can- ous ulceration of the soft parts which cover them, but scat- ered instances of its occurrence as a primary disease are record. Thus in the *Path. Soc. Transactions*, ix. 358, will found a description of this disease in the base of the skull. presented the appearance of a mass of fibroid tissue, the shes of which were filled with a yellow opaque and thick terial, which could be squeezed out in the form of comme- nes, and consisted of a mass of epithelial scales. But these es are of too rare occurrence to have much of practical portance; nor in the few scattered cases of colloid disease ecting bones with which I am acquainted, is there anything throw light on the controversy as to the malignant or non- alignant nature of that affection. Melanosis affects bones ry rarely, and probably is always a secondary formation; as in e case which has furnished the figure on p. 804. The osteoid ncer has been sufficiently described elsewhere in this work ol. i. p. 574).

In the *diagnosis* of cancer of the bones two difficulties present emselves—*first*, to distinguish between a soft tumour and an scess or other inflammatory affection; and *second*, to distin- nish between a malignant and an innocent tumour.

e following instance of the occurrence of abscess around a rapidly growing
ur, will illustrate the difficulty of the diagnosis in such a case. A young
an was admitted into St. George's Hospital under the care of Mr.
r Hawkins, complaining of pain near the ankle; no diseased appearance
existed. Soon, however, a soft swelling made its appearance, fluctuation
detected, and an incision behind the internal malleolus gave exit to pus
d with blood, and exposed a cavity which appeared to be that of an
nary abscess. After a few days arterial hæmorrhage came on, and soon
me uncontrollable. Pulsation also became evident in the swelling. The
sion was extended, and several pieces of soft, breaking-down tissue
ped; the finger passed into a mass of fungous matter springing from the
alcis. After amputation the disease was seen to be a soft tumour, about
size of a walnut, connected by a broad base to the calcaneum, and
rounding the posterior tibial vessels. The artery showed a small per-
tion.

It is seldom, however, that such difficulty is experienced as in
is case in forming the diagnosis; and if from the ambiguity
the symptoms, and the thickness or tension of the soft
rts over the swelling, doubt is felt as to the presence of a
ft solid or a collection of fluid, the introduction of a grooved
edle will in most cases decide the question. Usually the
bulated surface of the tumour, and the healthy and uninflamed
ate of its coverings, suffice to distinguish it from an abscess.

The diagnosis between malignant and innocent tumours is
ften very difficult, and sometimes impossible. It is of most
mportance, and unfortunately is also of most difficulty, in those
hich grow around the lower end of the femur. Malignant
nd myeloid tumours here often bear the strongest resemblance
o each other, so that the diagnosis in an early stage of the
ancerous affection can be only conjectural. By a reference to
the essay on TUMOURS (vol. i. p. 536) the reader will see that the points to which the surgeon is to direct his chief attention are the length of time during which the tumour has existed without constitutional or glandular affection, the bulk to which it has attained, and the extent of its attachment to the bone, since myeloid disease is an affection of the cancellous ends, while encephaloid often surrounds the shaft to a considerable extent, forming a long oval tumour, like a great ferule. But it must be allowed that the diagnosis between these forms of disease can hardly be expected to be accurate, inasmuch as there is strong reason for believing that myeloid tumours are occasionally malignant. There are other tumours also which could hardly be distinguished from cancer until a long progress had proved their innocence. Such are the fibro-cystic, to be

nosed as being cancerous. If there is a reasonable doubt whether the tumour be soft cancer or myeloid, or whether it be hard cancer or diffused bony tumour, undoubtedly the wisest course is to give the patient the benefit of that doubt, and to remove the limb at the lowest level at which the incisions can be carried clear of the tumour. Even if the disease should prove to be cancer, possibly the recurring disease may be in the cicatrix, and amputation of the stump at the hip-joint may prolong life. But so many cases are on record in which what has been supposed to be malignant disease in this part (and which in all the cases was most likely myeloid) has been completely arrested by amputation of the thigh, that it is only right to try the milder operation in cases not evidently cancerous.* In the fore-arm the character of the disease is usually better marked (as far as I have seen), or in dubious cases the alternative is not of much importance; nor in the humerus is the removal of the limb at the shoulder-joint by any means so formidable as in analogous operation on the lower limb. Hence in the upper limb the rule should be the reverse of that in the femur, viz. that in cases of doubt the entire limb ought to be removed.

What is the benefit of amputation in such cases as these? This is a question very difficult to determine, if the question be limited to the expectation of life. Scattered cases are met with here and there in which a disease apparently malignant has seemed to be checked after amputation; nay, where it has recurred after amputation, and then been checked by amputation higher up; † but these are rare exceptions. The disease may be expected to recur, and to prove fatal; and the operation must be defended rather on the grounds of humanity than of scientific indications, as affording relief from present suffering, and the chance of an interval of some months, perhaps even longer, of health, rather than as holding out much prospect of a radical cure of the complaint.

Pulsatile malignant tumour of bone and osteo-aneurism.—A remarkable feature in malignant tumours of bone is the occasional occurrence of pulsation in them. This pulsation can sometimes be with difficulty distinguished from that of ordinary or sacculated aneurism. The resemblance also which these malignant tumours of bone sometimes bear to the aneurisms by anastomosis is so strong that they have been described as 'aneurisms of bone,'* and have been believed to consist merely of a dilated vessel or vessels in the interior of an otherwise healthy bone. But it is now admitted that the great majority, at any rate, of these so-called 'osteo-aneurisms' were really pulsatile malignant tumours. The resemblance to aneurism by anastomosis is in the highest degree perplexing when the pulsatile tumour occupies a situation where that disease is common, such as the scalp.

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* See Mr. Gray's paper in *Med.-Chir. Trans.* vol. xxxix. p. 121

† *Path. Soc. Trans.* vol. vi. p. 291.

A woman applied at St. George's Hospital some years ago on account of a pulsating tumour on the vertex of the head. Mr. Prescott Hewett, under whose care she was placed, came to the conclusion that the disease was a malignant tumour of the skull, and dissuaded her from any operation. Being anxious, however, to have the tumour removed, she consulted another surgeon, who gave it as his opinion that the tumour was an aneurism by anastomosis, and might be extirpated. Mr. Prescott Hewett accordingly sought the advice of his colleagues, and after a careful examination they confirmed him in his original opinion, that the tumour was malignant, and had perforated the cranium. He therefore declined to operate; and the woman was placed at another hospital, by the advice of the gentleman whom she had subsequently consulted, and who then attempted to excise the supposed vascular tumour. The original diagnosis, however, turned out to be correct, and it became necessary to give up the operation. Such cases as these show the difficulties which may be experienced in diagnosing the nature of such a tumour in the scalp; but it more frequently occurs that the pulsatile tumour of bone is situated on the course of some large artery,† and simulates an ordinary aneurism (see article ANEURISM, p. 453).

The anatomy of these tumours is as follows: they spring from the cancellous interior of the bone, expanding and eroding its external shell, until they burst out, frequently on both sides of the bone at once, forming lobulated masses, which sometimes attain a large size. On section they are seen to be red, of a fleshy consistence, and containing large spaces or cells filled with blood, from the pulsation of which the tumour derives its movements, and which must therefore communicate freely with the main arteries around, though the exact nature of that conication has not yet been demonstrated. The pulsation ears to depend on the resistance of the periosteum, which is n thickened. Hence when the periosteum is penetrated, pulsation frequently disappears; as that of an aneurism will when the sac has given way. The microscopical characters oft cancer can be recognised in the structure forming the ls of the cells. Spicula of bone are often found mixed up h the malignant matter. The tumour frequently affects the ge veins in the neighbourhood, projecting into them, or even cking them up; and several such tumours may exist together, malignant disease of the ordinary encephaloid variety may found in some other organ of the body (see the case oted on p. 455).

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* See especially a paper by Breschet, '*Observations et Réflexions sur les Tumeurs sanguines d'un caractère équivoque, qui paraissent être des anévrismes des artères des os.*'

† Such tumours may, however, form in any bone with copious diploë. In the *Edinb. Med. and Surg. Journ.* Nov. 1860, p. 452, is an account of one which implicated the basilar process of the occipital bone and the first three cervical vertebræ.

The diagnosis of a pulsatile malignant tumour of bone is ry easy in some cases, almost impossible in others. It is easy en the tumour springs from a superficial bone, lies away from e course of any large artery, and has no bruit; and still more when other malignant tumours or symptoms of malignant sease are present; but where its connection with the bone is scure by reason of the depth at which its base lies, when a rge artery (which is generally the iliac, gluteal, or femoral) es near its situation, when its pulsation is accompanied by ruit,* when the tumour is solitary and the general health naffected,—it becomes a matter of the utmost difficulty. nough, however, has been said on this subject in the essay bove referred to.

In cases where other tumours exist, or where the symptoms f constitutional cancer are present, no doubt can be felt as to he inefficacy of local treatment; the disease declares its nalignancy by the same signs as cancer in other parts of the ody, and its prognosis and treatment must be the same. But re there any pulsatile tumours of bone of a different kind, in which the surgeon can hold out a hope that the excision of the tumour, or its consolidation by chemical agents, or by ligature of the artery which leads to it, will offer a reasonable hope of may therefore allow that in some rare cases, pulsation en noticed in innocent tumours situated on the long and displaying no other recognisable structure except ed vessels. It seems also that pulsation has been reed in a myeloid tumour;* and, as these tumours are r innocent, it would follow that the mere presence of ion in a soft tumour of bone is not to be considered as ive proof of its malignancy. If, however, we allow these ions to the rule that pulsating tumours of bone are ant, we must still admit that there is no reliable account such tumour connected with the skull or pelvis (those ite seats of the disease) which was otherwise than can-

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* Cruveilhier (*Anatomie pathologique*, 1856, vol. ii. p. 901) relates a very interesting case in which an encephaloid pulsatile tumour, springing from the bones of the skull, presented so marked a thrill, and a sound so exactly resembling that of arterio-venous aneurism, that he was led into the belief that such was the nature of the tumour, until dissection revealed its true character.

uch are our views with respect to the nature of the ile tumour of bone, our opinions as to the proper course tment cannot be doubtful. To tie a large artery is so rave a measure, that it can only be justified by the clear ct of impending fatal hæmorrhage, or by the presence of eurismal tumour pressing upon important organs. In pulsatile tumours, however, hæmorrhage is rare, and only late in the disease; nor are important parts often l upon, except in the cranium. If it be said that the n of the tumour will be checked by the ligature of its nt vessel, the answer is, that this is by no means borne experience, and that even if its growth were checked, ease would not therefore be cured; while the doubtful to be derived from a very uncertain diminution in the of the tumour is as nothing when compared to the ul risk of tying a large artery in a subject probably y debilitated by the cancerous cachexia. In many of the ed cases, the ligature of the main artery appears so far e affected the tumour as to have checked its pulsation. he pulsation, though a formidable symptom, is not an ial, and may not even be a constant, part of the disease. Professor Miller relates† a case of pulsatile malignant r in the ham, which was at first mistaken for aneurism. ulsation disappeared spontaneously, but returned after loratory puncture made in the tumour. Afterwards the

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y, 'On Myeloid Tumours of Bone,' *Med.-Chir. Trans.* vol. xxxix.

inb. and Med. Surg. Journal, April 1860, p. 963.

pulsation varied, disappearing occasionally, and then recurring.

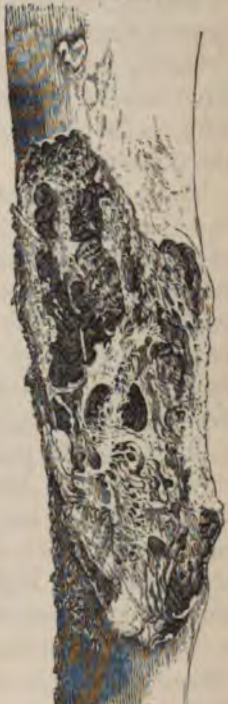
The purport, then, of all that has been noted as to the cour and nature of this disease, and as to the effect of treatmen appears to justify the following conclusions: that in pulsati tumours connected with the bones of the extremities, if t tumour be small and the other symptoms favourable, the surgeon is justified in treating the disease as an instance of t rare occurrence of osteo-aneurism, and endeavouring to extirpate it either by cutting away the portion of bone from whi it springs, or (better) by caustics or the actual cautery; th if it be of large size, amputation should be recommend through or above the nearest joint, except in those connecte with the lower end of the femur, where it may occasionally b advisable to amputate near the tumour; that the ligature o the main artery of the limb is unjustifiable; that in pulsatile tumours connected with the head, chest, or pelvis, no local measures ought, as a general rule, to be employed, but the disease should be treated as one of cancer; and finally, that the prognosis may be rendered somewhat less grave by remembering that pulsation has been noted in a myeloid tumour.

Cancerous ulceration is usually preceded by a known and evident tumour, probably epithelial; but in some cases the malignant deposit may have been entirely interstitial, and in others the patient is not seen until extensive ulceration has destroyed any tumour that might have existed. Such cases occur most usually about the bones of the face; and I have seen death produced where the lower jaw was implicated in a case of this kind, by the extension of the ulceration into the lingual artery. During life some difficulty may be experienced in distinguishing this cancerous affection from the rodent or phagedænic ulceration, spoken of at p. 759; but it is a matter of little practical importance, since amputation or complete excision would be recommended in either case, if the patient's general condition admitted of it. The bones of the face are peculiarly liable to extensive destruction in cancroid ulceratio and in lupus, but the chronic course of these affections sufficiently distinguishes them from cancer.

In the macerated bone, malignant ulceration produces extensive and irregular destruction both of the compact and cancellous tissue, without any trace of the periosteal and other inflammatory deposit that bounds the more healthy forms of ulceration (see Fig. 198).

NON-MALIGNANT TUMOURS.

Fig. 198.



Malignant ulceration of bone. (Museum of the Royal College of Surgeons. No. 640).

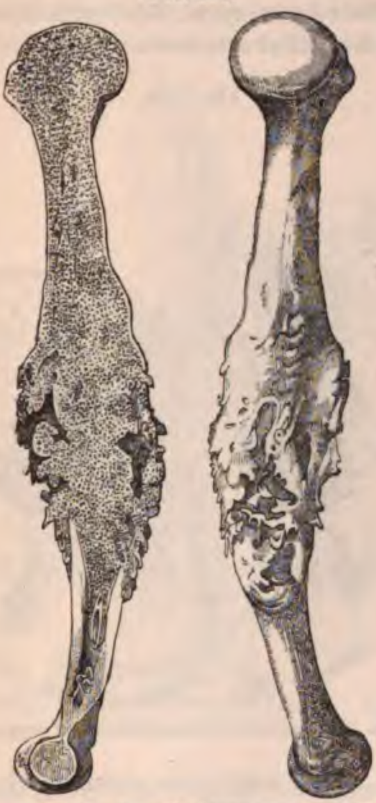
Tumours of bone are like those of soft parts in all important respects. They are innocent or malignant; the former being, for the most part, composed of some of the same structures as form the bone itself, in a more or less perfect state of development (homologous tumours); while the malignant tumours are composed of other structures, to which the osseous tissue in a state of health presents no analogues (heterologous). The parts which compose a bone are fibrous membranes, cartilage, the proper osseous tissue or granular base, and blood-vessels; together with the spaces or cancelli filled with fat, which give the bone the requisite lightness. Now any of these elements over-developed or imperfectly imitated may give rise to a tumour. The overgrowth of the fibrous tissue gives rise to the true fibrous tumour; its imperfect imitation by morbid action produces the various forms of fibroid or fibro-plastic tumour; excessive or misplaced growth of cartilage results in enchondroma; of bone in exostosis. Whether the vessels of bone are ever simply over-developed, without any other morbid product, so as to form the 'osteo-aneurism' spoken of by numerous surgical pathologists, is a question which has been discussed above. From the over-distension of the cellular spaces of bones, some of their cystic tumours probably arise; others are formed by a peculiar arrangement of the connective tissue in tumours belonging to different classes; and some of the growths, which are classified with cysts, are merely entozoa in the cancellous tissue. Lastly, analogous to the fat and medullary tissue which fills the cavities of the bones, we have a class of tumours, the myeloid, which, since their first description by Mr. Paget, have not ceased to attract much attention, on account of the interesting surgical and pathological questions connected with them.

Enchondroma.—Cartilaginous and bony tumours can hardly be treated of separately, for although the well-marked specimens of either class present little similarity at first sight, some of each are so intimately related, that the two could not without confusion be made the subjects of separate sections.

Cartilaginous tumours, or enchondromata, as they are called, have been already described in the essay on TUMOURS (vol. i. p. 530), so that it now only remains to speak of them as they affect the bones.

These formations may be divided, for surgical purposes, into two classes: the circumscribed and the diffused. The former as a rule do, and the latter do not, show a tendency to ossify throughout their whole extent; although even in the diffused enchondromata the part of the bone from which they spring is often occupied by a considerable osseous deposit, while the bulk of the tumour remains unossified. The diffused enchondromata usually grow as extensive infiltrations into the tissue of the bone and periosteum, and in the course of time spread slowly over the surface of the bone (retaining for the most part their covering of periosteum), and fill all the spaces or cavities in relation with the bone. Such was the case in the instance shown in Fig. 199, where the whole medullary canal of the shaft of the humerus is occupied for a considerable extent by porous bone forming the base of a cartilaginous tumour, which surrounded the bone, and had been growing for a long period without much inconvenience to the patient. It is difficult to determine their precise origin, and thus to make sure whether they are new formations, in a strict sense, or out-growths; but the former opinion seems more generally probable. I have, however, met with one of these tumours, in the phalanx of the finger of a child, where it seemed probable that the origin of the tumour was the epiphysial cartilage. These non-ossifying cartilaginous tumours, or pure enchondromata, are little amenable to surgical treatment, unless in a part favourable for amputation. They have been supposed to present some analogy to malignant diseases, to which, indeed, their ve diffusion and steady irresistible progress do offer a lance. They differ, however, from the true cancers at e in one feature, which is quite characteristic, viz. that r extensive their diffusion, they affect the surrounding nly by pressure or absorption, not by contamination. their most distinctive feature; but it is not so useful in sis (since it is less easily appreciated during life) as their growth, which is usually slow. To this rule there are,

FIG. 199.



ierus in a case of diffused cartilaginous tumour. (Museum of St. George's Hospital. Series ii. No. 183.)

r, rather frequent exceptions, of which three remarkable es are related by Mr. Paget,* in one of which the rapid of the tumour led to the erroneous diagnosis of malig- and so deprived the patient of the chance of recovery

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* *Lectures on Surg. Path.* vol. ii. p. 181.

which amputation would h
and similar cases, we mu
malignancy in the case o
fact of rapidity of growth
suspicious and unfavoura
large cartilaginous tumou
and this should be taken i
the propriety of amputatio

The structure of thes
quite solid; in other cases
them, as in the beautiful

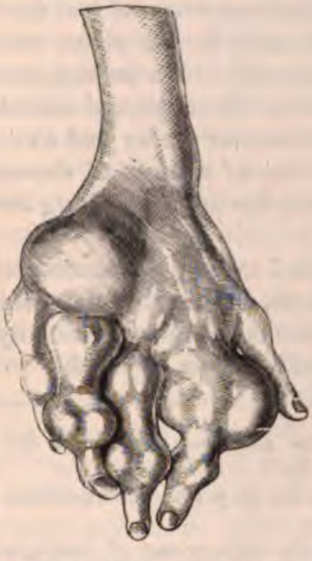
Cystic enchondroma. (Museum

figure was taken. They s
lage; but more commonl
sparing quantity, in some
appearances will be foun
ferred to.

The circumscribed cartil
more frequently met with,
in practical surgery. They
long bones, the phalanges

frequent seat. A small enchondroma is comparatively met with, springing from the end of the last phalanx of reat toe, raising the nail up, and giving a good deal of in wearing the boot. It should be cut away from the , and usually will not return; should it do so the phalanx be removed. In the hand and foot, enchondromata are found in great numbers at the same time; and the arance thus presented is very characteristic, and is not, as s I know, imitated by tumours of any other kind. The rs are studded over with bosses or knobs, looking some- g like the dry gnarled branches of an old tree. Of this

Fig. 201.



odel of a hand affected with numerous enchondromata. (From the Museum of St. George's Hospital.)

of disease the annexed is a good illustration. This affec- is seen generally about the age of puberty. It is, of se, quite incurable, except by amputation; but that measure ld never be resorted to in any disease of the hand without nt necessity. In the foot less scruple need be entertained, the foot, deprived of its anterior portion, is still a very l member; and there would be no necessity, even in a advanced case, for going further than Lisfranc's or Cho- s operation. I have never seen a case where anything more was required than to remove one or two toes. In the hands, these multiple enchondromata, if left alone, grow generally very slowly, and sometimes not at all. Cases are, however, on record where they seem to have increased slowly during the whole period of life, and to have attained at length a truly extraordinary development. Of this the specimen figured by Müller* is an excellent instance; and a very similar case has been described and figured by the writer,† where, however, the cartilaginous structure was less distinct. Such tumours usually originate in the interior of a bone, expanding its walls into a thin bony cyst or shell, which is liable to give way at different parts, and firm pressure will then elicit a feeling of crepitation (see Fig. 202, on p. 821). These multiple enchondromata, like the diffused cartilaginous tumours just described, seem to show little tendency to ossify in the strict sense of the term; but they undergo, when very old, a process of calcareous degeneration, which, added to their general increase in size, produces ulceration of the skin over them; and so a condition is brought about not unlike that of a mass of enormous chalkstones exposed. More rarely the tumours spring from the surface of the bones.‡

Circumscribed and solitary enchondromata usually grow from the surface of a bone, and most of them show a strong tendency to ossify, the process commencing generally at the base. Hence the surgical considerations applicable to them are identical

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* *Ueber den feinern Bau und die Formen der krankhaften Geschwülste.* Berlin, 1838, tab. iv. fig. 1.

† *Path. Soc. Trans.* vol. ix. p. 382. The specimen is in the Museum of St. George's Hospital.

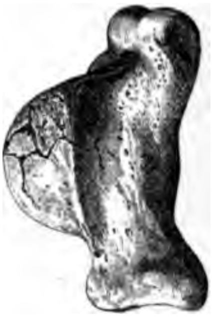
‡ With regard to the ordinary seat of cartilaginous tumours of bone, Dr. Pirrie makes the following observations, which I believe to be generally true: 'I have now seen in my own experience nine specimens of cartilaginous tumours near the ends of long bones, and they have all been situated between the walls of the bone and the periosteum, and in no instance extended to the cartilage of incrustation at the end of the bone. I have met with fifteen examples in metacarpal bones, and they all originated within the bone, and caused more or less of expansion of the walls and their conversion into a thin crust or shell around the tumour, in various instances at parts completely absorbed. I have seen and carefully examined seven examples of the same kind of growth in the middle of the long bones, and they were all placed within the canal and around the wall of the bone. Judging from my own comparatively limited experience I would conclude that the favourite site of the first class is around the bone; of the second within it; and of the third, both within and around it.'—*On Acupressure,* p. 107.

those which apply to exostosis. When a circumscribed
ondroma grows in the interior of a bone, as in the figure
e referred to, it can be readily enucleated, and when a
l cartilaginous tumour springs (as it often does) from the
of the last phalanx, usually of the great toe, its removal is
easy, and is always, as far as I have seen, permanently
essful.

iagnosis.—The diagnosis of innocent tumours from each
r is uncertain and obscure in all parts of the body, and
aps more so when they are connected with the bones, on
unt of the generally deep position of the latter. If, how-
, a tumour presenting the general characters of innocency
be clearly made out to be springing from bone, the chances
very great in favour of its being an enchondroma or an
stosis. If very large, it can hardly be the latter without
playing characteristic hardness. Fibrous and fibroid tu-
urs may be found of large size; still almost all large non-
lignant tumours of bone are cartilaginous. Most, also, of
smaller tumours, which do not possess the hardness of
stosis, will be found to be cartilaginous. Such tumours
ally possess a certain amount of resilience, and often appear
curely movable on the bone. This sensation, however, is
en deceptive, and due, apparently, to the motion of the soft
ts upon the tumour; it has been noticed in tumours, the
e of which has been found to be completely ossified, and a
ht amount of apparent movement is therefore no conclusive
on for denying the connection of a tumour with the bone.
ther thing which ought to be taken into account in diag-
s is, that the cartilaginous, equally with the osseous, tu-
rs may have a bursa over them. This will not often be an
acle in the way of making out an exostosis, since the
ness of the latter is transmitted through the fluid, but may
times cause doubt about the nature of an enchondroma.
nodulated surface of enchondroma, though characteristic
certain extent, is far from distinctive of the disease;
same property may belong to colloid disease, fibrous tu-
r, and other swellings; in fact, the only sensation which
ds a reasonable ground for pronouncing a tumour cartila-
us is resilience combined with solidity; and this for deep-
ed tumours is often deceptive, and in the many enchon-
ata enclosed in shells of bone is, of course, absent. On the
e, therefore, an enchondroma is best known by its being

und some of the loose exostoses previously referred at it is possible that some exostoses may be developed, sses of bone are which form so striking a feature rheumatic arthritis, in the soft structures near the result of inflammation, and may afterwards coalesce riginal bone. The great majority, however, of those urs which are called, in surgical language, exostoses, y an out-growth or limited hypertrophy of analogous as fatty, fibrous, and other innocent tumours do, pendent of any inflammatory symptoms. Many specially the French surgeons, speak of 'bullous meaning apparently by this term those shells of bone etimes are formed by the development of a tumour cartilaginous) in the centre of the shaft. Such a he one from which the accom- gure is taken. Another kind of s that which proceeds from the n of tendons, or from the occur- nan of processes of bone natural rer animals. Both of these be- r to the class of museum curiosi- f subjects of practical interest. ey became objects of treatment, l probably be indistinguishable stoses, and would require the ation. Few museums are with- imen of ossification of tendons fibrous tissues. Some cases of will be found referred to on p. 686, the treatment of persons pre- is tendency is discussed. Such hose in which a process projects humerus around the brachial artery, when that vessel e course usual in the large feline animals, in which it ded by a ring of bone, only need to be known in order perative interference; and in any operations on bony n regions where such anomalies are known to exist, e and history of the case ought to be first carefully ed.

FIG. 202.



Bullous exostosis on the phalanx of a finger; probably a shell of bone expanded around a cartilaginous tumour. (From a preparation in St. George's Hospital, Series ii. No. 151.)

ing these rarer varieties, the cases of circumscribed

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* Gay, in *Path. Soc. Trans.* vol. iv. p. 244.

exostosis which surgeon
classes—the cancellous,
reproduction of the tissu
hard exterior of the bone
in the essay on TUMOURS

Treatment.—The slow
the ease with which the
the gradual advance of t
cessary to meddle with
the operation until it i
there is always great ri
tumour, and still greater
must be done in dividi
suppuration in the interm
are very liable to follow

Ivory exostosis which was trephi
Exfoliation was afterwards p
—chiefly nitric acid. (Fro
No. 189.)

is of the ivory variety, an
tion is much more dan
quently happens that the
tools which can be broug
cally impossible to remov

A striking example of this
paration to the Museum of St.
small ivory exostosis in the fro
Keate, one of the boldest and
severingly, but vainly, endeav
mallet, during the space of nea
bone. The patient was fortuna
Mr. Keate, convinced of the
attempt the extirpation of the t

ic acid to its exposed base. This was successful. The caustics, in the f years, ate their way through the base of the tumour, which dropped tumour figured in the accompanying illustration (Fig. 203) still shows groove worked into it by the trephine at the time of the operation.

rould be rash to say that such operations are unjustifiable, xostosis in the neighbourhood of the orbit may grow into avity, or into the cranium, and cause death, or some hor-eformity almost worst than death, by displacement of the r bones of the face ;* but the risks of operating on these exostoses about the cranium should be maturely weighed. tumours, however, which present on the surface the cha- of the true ivory exostosis, may turn out on section to be nly on the exterior, and to consist of a soft diploic tissue ally. This is the case usually, if not solely, when the bone rhich the tumour springs resembles the composition of the f the skull, that is to say, consists of diploë covered by a ble of compact tissue. In bones of which the shell is more such as the lower jaw, it is much more probable that the thickness of the tumour will be of compact structure. The ses which consist of diploë internally covered by a thin f hard substance (and which I venture to think more n than they are usually said to be), are, of course, much easily removed than the true ivory exostoses which they te ; and another circumstance which renders the prospect rations on large exostoses, whether on the skull or other rather more promising than would appear at first sight, the tumour when exposed is sometimes found to be con- to the surface of the bone by a very narrow neck, from it can be easily broken or cut off.† It is, however, only that either the surgeon, or the patient, will make up his o the dangerous and doubtful experiment of an operation ivory exostosis, especially of the cranium; whereas ions on the more common forms of exostoses which spring he shafts of the long bones, and present the cancellous,

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ne remarkable specimens are in the Museums of St. Bartholomew's l and of the College of Surgeons. Exostoses of the orbit are not of this dense quality. See a case in *Path. Soc. Trans.* vol. xi. p. 264, he tumour was soft, and easily removed.

most interesting case of a tumour of this kind, growing from the , is reported in the *Path. Soc. Trans.* for 1850, p. 149, with a drawing, been commented on by Mr. Prescott Hewett in his Lectures on Diseases Head.

he 'bullous exostosis,' or central enchondroma contained in
›ny cyst, usually requires amputation of the phalanx upon
ch it is seated.* It may, indeed, be sometimes possible to
cleate the growth, and I have seen this done with success;
as a general rule it is hardly worth while to attempt it;
›e, if the disease be seated in the hand, the necessary dis-
bance of the tendons would probably render the finger use-
› ; and if in the foot, the certainty of a speedy and complete
overy would outweigh the advantage of preserving a portion
one of the toes.

Diffused bony, or innocent osteoid, tumour.—Besides these
ms of limited exostoses, a diffused bony tumour is occasion-
y met with, in which the whole thickness of the bone for
me distance is converted into a lobulated mass of spongy
ne, which, in a section of such a tumour that I had the oppor-
nity of examining microscopically, presented the usual struc-
re of bone, but with smaller cavities, and an increased
posit of the granular base.

The specimen (in the Museum of St. George's Hospital, series ii. No. 185) is
ger than a man's fist, and involves one side of the lower jaw, from the
ndyle to near the symphysis. Its innocent nature is clearly proved by the
ct that it had been growing for five years without any detriment to the
neral health, and had been partially removed on a previous occasion without
y ill consequences from cutting into the interior of the tumour. On the
tient coming under the care of Mr. Tatum, the tumour was completely
cised, and with success, as the man was seen in perfect health several years
terwards.†

Another still more remarkable case is illustrated by a series of three pre-
rations in the Museum of the College of Surgeons. The history is so
teresting that a condensed report of it must be introduced. The thigh was
iginally amputated on account of a hard and heavy dry osseous substance,
rrounding the ends of the femur and tibia, projecting into the knee-joint,
tending far up the thigh, and implicating the popliteal artery, vein, and
rve, so as to cause œdema and severe pain (Prep. No. 3244) shown in the
companying figure. The patient remained well for five years; then another
teoid tumour formed on the stump of the femur, accompanied with severe
in. Amputation was performed higher up. The tumour appeared to grow,

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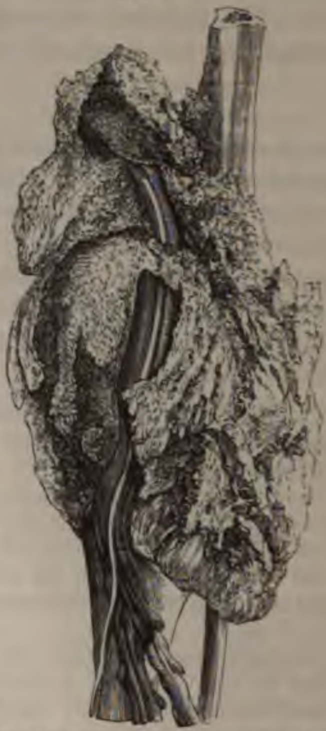
int, since the presence of the tumour has probably caused numerous attacks
synovitis, which have left the pouch of synovial membrane extending up
e thigh permanently enlarged.

* I have never seen a tumour of this sort connected with the larger
nes; but the statement in the text would apply still more forcibly to such
umour.

† *Path. Soc. Trans.* 1848-9, p. 95.

not from the bone itself so much as from the periosteum, and femoral artery (Prep. No. 3245). There was again an interval of two years; then a fresh tumour formed about the stump, continued upwards, out of reach of operation, and finally killed him, from in and sloughing of its soft coverings, *twenty-five years* after the first of the disease. He had been in good general health during the (Prep. No. 3245, A).*

Fig. 204.



Diffused bony tumour of the femur and tibia: the popliteal vessels and surrounded by the bony growth, the veins varicose from the pressure. overlaps the fibula, which, however, is not affected. (Museum of the of Surgeons. No. 3244.)

This history presents a remarkable analogy to that of current fibroid, or fibro-plastic, tumours of soft parts. are the same leading features, viz. the local malignity disease combined with innocence constitutionally, its imitation of the tissues in which it grows, its constant rence near the site of an operation, and, finally, the

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* Another, and very similar, case may be found in Mr. Paget's *Surgical Pathology*, vol. ii. p. 506.

th—from exhaustion and sloughing after repeated opera-
ıs, not from infection of the system.

ysts in bone are of two kinds; viz. serous and sanguineous.
e serous, or mucous, cysts which occur in the jaws as a con-
uence of irregularity of the growth, or position, of the teeth
l be found treated of in a subsequent essay. In such cases
formation of a cyst containing clear fluid is susceptible of
intelligible explanation; but it is difficult to see how simple
ous cysts can be developed in other bones, and probably the
cases which are to be found in books rest upon erroneous
agnosis.* But cavities containing clear fluid are formed in
nes by the growth of hydatids in their interior; and if simple
sts do occur, they would be indistinguishable from hydatid
sts before operation, and would require the same treatment.
Blood-cysts are not of common occurrence, nor is it usually
sy to determine their pathological nature. Many of the
ses reported under this title appear to have been examples of
lignant tumour, in which a cyst has been developed, much
eeding in relative size the solid portion of the growth.†

'he most distinct description of a blood-cyst in bone to which I can refer is
Travers, in the *Med.-Chir. Trans.* vol. xxi. He excised the greater part of
clavicle, on account of a large cystic tumour of about a year's growth,
ch was very clearly connected with a history of injury. The tumour
isted of an arrangement of cells or chambers, of pretty equal dimensions,
l with dark solid coagula of blood, with spicula of bone in their walls, and
sted by a very stout fibrous membrane. 'The investing membrane was
ently the condensed periosteum, the cells were the irregularly-expanded
elli, and the calcareous particles were the débris of the bony plates and
s.' Travers is inclined to attribute the disease to expansion of the bony
elli from blood effused into them as the result of violence. If this ex-
ation be accepted, the affection would be identical with the blood-tumour,
ıæmatoma, which is occasionally found in the soft parts as the result of
tusion (see vol. i. p. 622). Mr. Stanley also relates a case ‡ in which he
putated the thigh successfully on account of a blood-cyst originating in the
dyles of the femur, and where both the femur and the tibia presented 'an
hymosed condition from minute effusions of blood through their compact
ıue.' This condition existed in the femur up to, if not above, the level of
amputation; yet the disease had not recurred six years afterwards. Mr.

Mr. Stanley (op. cit. p. 194) denies the formation of simple cysts in any
er bones than those of the jaw.

See a case reported by Mr. Liston, under the name of 'ossified aneurism
he subscapular artery,' *Ed. Med. and Surg. Journ.* vol. xvi. pp. 66, 215.

Op. cit. p. 187.

Stanley, however, in his description of this tumour, is careful to mention the fact that there were distinct portions of solid matter attached to the inside of the cyst, and would evidently, but for the progress of the case, have been inclined to refer it to the incipient stage of cancer.*

Blood-cysts could only be distinguished from serous or hydatid cysts by puncture. In the great majority of cases they would require complete removal, by amputation if necessary. If the surgeon can satisfy himself of the absence of all soft solid matter around the cyst, he may in rare cases be justified in endeavouring to procure its obliteration by laying it open and stuffing it with lint; but it must be borne in mind that such measures can only do harm if there be anything of a malignant taint about the disease.†

Fibrous and fibro-cystic tumour.—The great majority of the innocent tumours of bone which are not osseous will be found to be cartilaginous or myeloid; but a smaller number present the fibrous character more or less perfect. Perfect fibrous tumours appear as outgrowths from the periosteum; and the most familiar examples of them are the fibrous polypus of the nose, which is treated of in the essay on DISEASES OF THE NOSE, and epulis, which will be found treated of among the DISEASES CONNECTED WITH THE TEETH. As in other situations, fibrous tumour could hardly be distinguished from enchondroma before removal, and the diagnosis, even if it could be made, would be quite unimportant. We need not, therefore, give examples of the disease occurring in other parts of the body. Scattered specimens will be found in most of our large museums, and in many of them ossification will be found to have made some progress. In some of these cases the innocent nature of the disease is proved by the history, in others it is an inference from the structure of the tumour. Calcification occurs in these as in other fibrous tumours (St. George's Hospital Museum, ser. ii. No. 152).

Fibro-cystic tumour of bone is a disease which is little known, and may therefore possibly be of very rare occurrence. It is, however, also possible that this apparent rarity may be due to the fact that most of the examples of this disease have been confounded with malignant tumours. A very interesting account of a growth of this sort connected with the femur, in which the limb was removed at the hip-joint by Mr. J. Adams, will be found in *Path. Soc. Trans.* vol. v. p. 254, and, appended to the account of this case, a report by Mr. Prescott Hewett on three similar cases, in all of which the femur was the seat of the disease, and in all of which the patient recovered after amputation, and remained well for many years afterwards. There is therefore the strongest reason to believe that the disease was not cancerous. It commenced, in each of the four instances alluded to, in the cancellous tissue of the bone, making its way outwards, infiltrating the shaft, and causing spontaneous fracture; so far, therefore, exactly resembling cancer. It gave the sensation of an elastic substance, with fluid here and there in cavities. There seems to have been no diagnostic mark between it and cancer during life, except the negative indications to be derived from the absence of glandular or constitutional contamination during a somewhat long disease, the duration of the affection being, in the two cases in which that point was noted, three and four years respectively. On examination after removal, the innocent nature of the disease was inferred from the large quantity of firm glistening fibrous tissue of which nearly the whole solid portion of the tumour was formed, the presence only of such cellular elements as are found in growing fibrous structures, and the absence of cancer-juice, or any other indication of a tendency to disintegration in the tumour, or infiltration of neighbouring tissues.

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* It is possible that this affection may have been, as Mr. Paget hints, a myeloid tumour, in which the cysts, which are so common in that disease, were developed out of proportion to the solid part (see vol. i. p. 536).

† In Nélaton's *Path. Chir.* vol. ii. p. 48, will be found a striking representation of a large multilocular cystic tumour developed in the femur, and containing bloody fluid. Unfortunately there is no history of this case.

Myeloid tumours, the only other form of innocent tumour which it is necessary to particularise, will be found sufficiently described in vol. i. p. 535.

Entozoa in bone.—A very few words must suffice for the description of the cases of entozoa in the interior of bone. The entozoon appears to have been the ordinary echinococcus in all cases except one quoted by Mr. Stanley, in which the cysticercus telæ cellulosæ is said to have been found in the interior of one of the phalanges. The subject is of no very great practical importance, since it is seldom possible to diagnose the nature of the affection previous to operation. The cases are so rare, that in the great work of Rokitansky[*] only eight are referred to, as the total number which he supposes to have been then observed. A search, however, through the various pathological collections would probably discover many more than these.[†] It is noticed by Rokitansky,[‡] that the disease appears often to be directly induced by some injury; but it is difficult to believe that this can be otherwise than accidental. The disease runs a protracted course, and if the shaft of a long bone be the part affected, fracture, spontaneous or accidental, is very probably the first thing noticed. The fracture, in all probability, does not unite; and it has sometimes happened that in an operation, undertaken for the purpose of resecting the ends of the fracture, the hydatid cavity has been exposed and the globular acephalocysts discharged.[§] Amputation is then indicated in ordinary cases; but one is on record, in which the hydatids were scooped out of the cavity of the cyst, which then filled up and a complete cure was obtained.[‖] In other cases, the seat of the disease is in a flat bone, as the skull,[¶] or ilium,[**] or in the expanded head of one or more of the long bones.[††] These cases are quite within the reach of cure when their nature is discovered; and in some rare instances, as in Mr. Coulson's and Mr. Stanley's cases, the discharge of hydatids through a spontaneous opening or a puncture, enables the surgeon to determine the nature of the disease beforehand. Failing this, the symptoms are precisely those of any other cystic tumour of the bone.

The treatment appears to be usually successful. The cyst is to be freely laid open, with the trephine or bone-nippers if necessary; all the hydatids removed, and some caustic* applied to the whole interior of the cyst. In most of the recorded cases this has been sufficient; but in Mr. Coulson's case the cure was not completed until after the separation of a small piece of bone from the floor of the cavity, which on examination was found thickly studded on both its surfaces with a great number of minute hydatids.

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[*] *Syd. Soc. Trans.* vol. iii. p. 184.

[†] The Museums of Guy's and St. Thomas's Hospitals contain at least five specimens.

[‡] Loc. cit. See also the histories of the cases which have furnished the specimens to St. Thomas's Hospital Museum, marked ser. c, Nos. 230, 253.

[§] Dupuytren, *Leç. orales*, 1839, vol. i. p. 52; St. Thomas's Hospital Museum, ser. c, No. 230.

[‖] Mr. Wickham's case, *London Medical and Physical Journal*, vol. lvii.

[¶] Keate, in *Med.-Chir. Trans.* vol. x. St. Thomas's Hosp. Museum, c. 6^{1}.

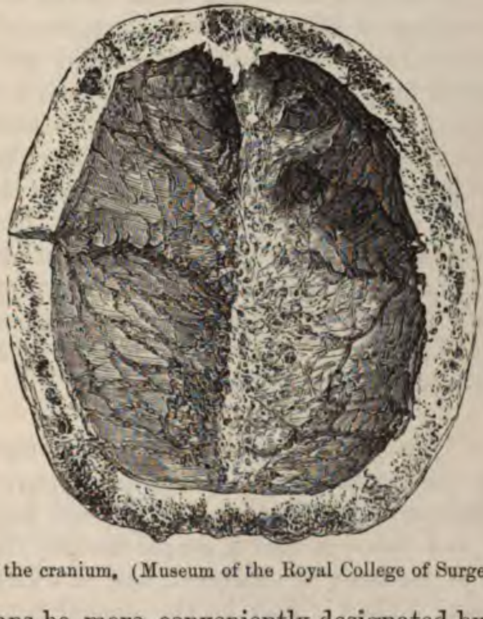
[**] Stanley, op. cit. p. 190.

[††] Coulson, in *Med.-Chir. Trans.* vol. xli. In the specimens in St. Thomas's Hospital Museum, c. 253–4, hydatids were found simultaneously in the lower end of the femur and contiguous head of the tibia. Other cases are noticed in the bodies of the vertebræ. Dupuytren, loc. cit. Guy's Hospital Museum, No. 1029^{30}.

HYPERTROPHY AND ATROPHY OF BONE.

The condition of bone usually known by the name of hypertrophy is very generally the consequence of chronic ostitis, and would perhaps be more conveniently designated by some name expressive of its inflammatory origin. Thus, most of the specimens of 'hypertrophied cranium' seen in our museums will be found, if the history be known, to be taken from cases of injury, or to be connected with syphilis or scrofula. The cases also of elongation and thickening of the bones of the leg, related by

FIG. 205.



Hypertrophy of the cranium. (Museum of the Royal College of Surgeons. No. 2858.)

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* Nitrate of silver, lint impregnated with a saturated solution of sulphate of copper ('blue lint,' as it is called at St. George's Hospital), caustic potash, and the actual cautery, have been used.

Mr. Stanley[*] under the head of 'hypertrophy,' appear all of them to fall more naturally under consideration with the sequelæ of inflammation, which have been described above. It appears that this thickening may go on for an indefinite period after the cessation of any symptoms, and that the enlargement of bulk which follows from it is permanent. It is true that in many of the cases of thickening, whether of the skull or of the long bones, which are preserved in pathological collections, no history of injury or inflammatory affection has been obtained; but the exact resemblance of the specimens to those in which such a history does exist, leaves no doubt that most of them are specimens of chronic inflammation. Cases do, however, occur, though so rarely as to be rather matters of curiosity than of practical interest, in which a bone (the skull for the most part) has gone on increasing in size without any symptoms except those produced by its increase in bulk. Such was the well-known instance related by Mr. Prescott Hewett, in his lectures at the Royal College of Surgeons, in which a man's skull continued to increase in size from year to year, with no symptoms whatever, so that he was only aware of the fact from the increasing size of his hat. The disease, however, in this case was clearly traced to an injury. As no symptoms can be attached to such cases, no treatment is known to have any influence upon them. In the absence of any constitutional affection, the persevering use of counter-irritation, by iodine or blistering, would appear to hold out most hopes of checking the growth.

Atrophy of bone is a more frequent and a more important disease than the opposite condition of hypertrophy. Inflammation, fatty degeneration, disuse, and injury are frequent causes of atrophy; and there is also a simple atrophy, in which the composition of the bone is unaltered, and in which no obvious cause is present (unless it may be the general failure of nutrition in advanced life), and where the amount of bony tissue becomes gradually less and less, until the bone is no longer strong enough to resist slight violence.[†] As a consequence of senile change, or fatty degeneration, atrophy is one of the most common causes of spontaneous fracture. It may also occur in any bone, to some extent, as a consequence of confinement g a lingering disease.* Brodie says,† 'All bones in a of inaction lose a great part of their phosphate of lime. compound fracture, when the patient has been long aed, the bones in some instances become as soft as a scro- s bone, so that you may cut them with a knife.' The which are spoken of under the name of 'fragilitas m' appear to belong for the most part to the class of fatty nile atrophy. Injury sustained in fracture is also a fre- t cause of atrophy. Of this, the most extraordinary nce is that quoted by Norris,‡ in which, after two fractures rring at the same point, near the middle of the humerus, whole bone disappeared, so as to leave the fore-arm 'swing- ither and thither like a thong,' and the arm shortened iches. It is expressly stated, in the account of this curious that there was no open sore, and that the bone disap- d 'by the gradual action of the absorbents.' Mr. Curling§ ves that the cause of atrophy after fracture may often, if lways, be found in injury to the medullary artery. Even ing, however, that this explanation is plausible in some , there are others (not to speak of extreme instances like ne just cited) where it cannot apply. Such are cases of hy of both fragments, or of the bone in the neighbourhood e fragments, while the latter are not so much atrophied.‖ phy from inflammation is a condition illustrated by many id preparations, though it does not attract much attention actice. It is merely the persistence of that degenerative ge which leads to inflammatory softening; and probably of the cases of atrophy after fracture should be referred is head.

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[*] Op. cit. p. 5.

[†] Humphry, *On the Skeleton*, p. 8.

nnected with atrophy is the suspension of growth, oc- nally, though rarely met with, in which the epiphyses in separate from the shaft of the bone; and it seems ble that injury to the epiphysial cartilage, in separations

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ee a preparation, No. 384, in the Museum of the Royal College of ons, with its history.

ect. on *Pathology*, p. 409.

mer. *Journ. of Med. Sc.* Jan. 1842, p. 39.

fed.-*Chir. Trans.* vol. xx.

ee a preparation in St. Thomas's Hospital Museum, series c. No. 2. Here ophy is most marked in the *upper* part of the shaft; and the fragments ed between the fractures (which were triple) are thicker than either of rtions of the shaft.

of the epiphysis, may occasionally give rise to shortening of the bone from suspension of growth between the shaft and epiphysis.*

Atrophy of bone is an affection which does not appear to be marked by any peculiar symptoms, or to admit of any special treatment. After injury to any part, the restoration of moderate functional activity as soon as it can prudently be recommended, the avoidance of any cause of pressure on the main vessels or those of the surface, and the choice of a suitable posture, with attention to the general health and nutrition, are the objects of a judicious treatment, irrespective of the condition of any particular part; and these measures are all that could be suggested to avert atrophy of the bone, even if it were known to be impending.

Spontaneous fracture has been mentioned repeatedly in the previous pages, in connection with several morbid states, which may be thus enumerated in the order of their presumed frequency as causes of fracture: viz. senile atrophy, malignant disease, tumours of other kinds, including hydatids; the ulceration which accompanies necrosis, and, lastly, other kinds of ulceration. But besides these, cases of spontaneous fracture occur without known cause; sometimes in making a violent muscular effort, as in throwing a stone, or striking a blow; at other times in the most ordinary action, as in turning in bed, quiet walking, &c. Those which are caused by violent muscular efforts too nearly resemble the ordinary cases of fracture (particularly fractures of the patella) to call for any remark here; and the treatment of the fracture in the cases which occur during the progress of known disease is a matter usually of subordinate importance, and has been already sufficiently discussed in treating of the disease. I would merely add, that when the long bones are perforated by ulceration occurring around a sequestrum, the question of amputating the limb, or attempting to save it, will demand much care, and that, as a general rule, amputation will not be required in the upper extremity, nor should it be performed in the spontaneous fracture which rather frequently follows acute necrosis in children, unless the general health is evidently giving way; but in other cases of necrosis of the bones of the lower limb, and in almost cases of ulceration not due to the separation of a large iestrum, amputation as a general rule is indicated. When ture occurs during the ordinary muscular exertion of every- life,* and in persons not known to labour under any disease, ous remote causes have been imagined, but none have n proved to be really efficient. The one most commonly nitted is syphilis; but, not to dwell on the fact that the ident has occurred in many persons in whom the strongest son existed for believing that no such taint was present, that we know of the action of syphilis on the bones tends to w that (apart from ulceration and the separation of necrosed tions) it renders them not more but less brittle. The ctical point of chief interest connected with such cases is, t there is no reason to despair of union, and that they ould be treated in the ordinary way, with perhaps more than e ordinary care to avoid constriction of the soft parts.

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* *Surgical Treatment of Diseases of Infancy and Childhood*, 2nd ed. p. 238.

WOUNDS OF BONE.

It is not necessary here to dwell upon wounds of bone, since e reader will find all that is practically important in the essays n FRACTURES, GUN-SHOT WOUNDS, and INJURIES OF THE HEAD. ases of incised wounds of bone without fracture do, it is true, ccasionally come under the notice of the surgeon. The chief terest in such injuries lies in the probability of diffuse sup- uration (osteo-myelitis) supervening, or of the separation of e periosteum, which is a common event in such cases, leading necrosis. A reference to those sections will illustrate suffi- iently the prognosis and treatment.

T. HOLMES.

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* Some interesting cases are to be found in Robert, *Conf. de Clinique Chir.* 361; and many are scattered about in various books and periodicals. I member seeing at St. George's Hospital a stout, florid young man who had actured his thigh in simply walking across his room, without catching his ot or making a false step. It healed like any other fracture.

END OF THE THIRD VOLUME.

LONDO
SPOTTISWOODE AN
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M31 Holmes, T., ed. v.3,16902
H74 A system of surgery
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